SCIENTIFIC AMERICAN

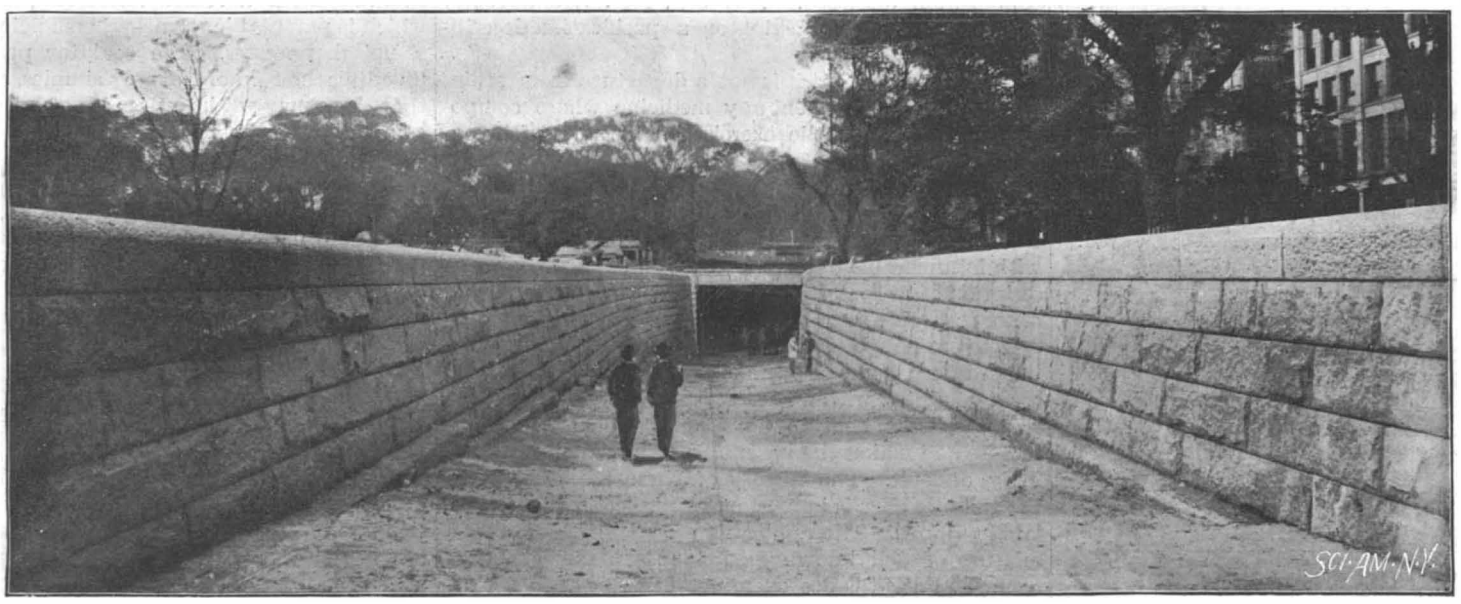
[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyright, 1896, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXV.—No. 10. ESTABLISHED 1845. NEW YORK, SEPTEMBER 5, 1896. $3.00 A YEAR. WEEKLY.

THE BOSTON ELECTRIC SUBWAY.

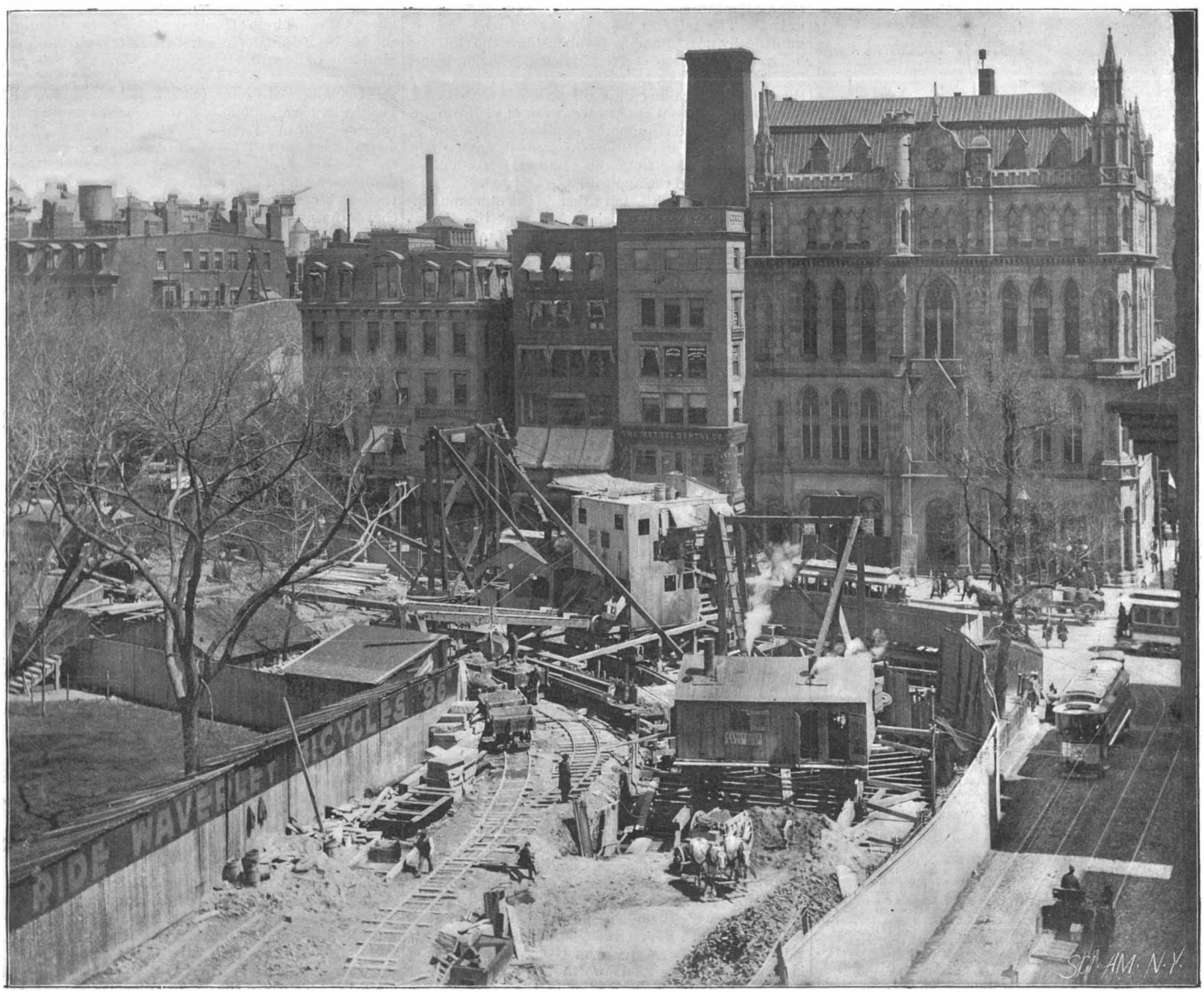
Many years ago it became apparent that Boston required additional facilities for the transportation of street car passengers through the lower parts of the city. The problem of rapid transit was for a time somewhat unsatisfactorily solved by the introduction of a very complete system of overhead trolley covering the city and immediate suburbs. From the æsthetic and sentimental standpoints, to say the least, this wholesale introduction of the overhead trolley was not acceptable, and as the population increased, the electric roads have proved entirely inadequate to deal with the problem in the congested portions of the city. This applies to the region about Boston Common, where, especially on Tremont Street, bordering its eastern side, blockades are of very frequent occurrence, and where hundreds of feet of the street at a time are filled with trolley cars, working their way along as best they can. We have in a preceding issue spoken of the new electric subway road then and now in process of construction in Boston. Much work has been done upon it since that period, and the aspects of the work at different periods are the subjects of our illustrations.



ENTRANCE TO THE SUBWAY BY THE PUBLIC GARDEN INCLINE.

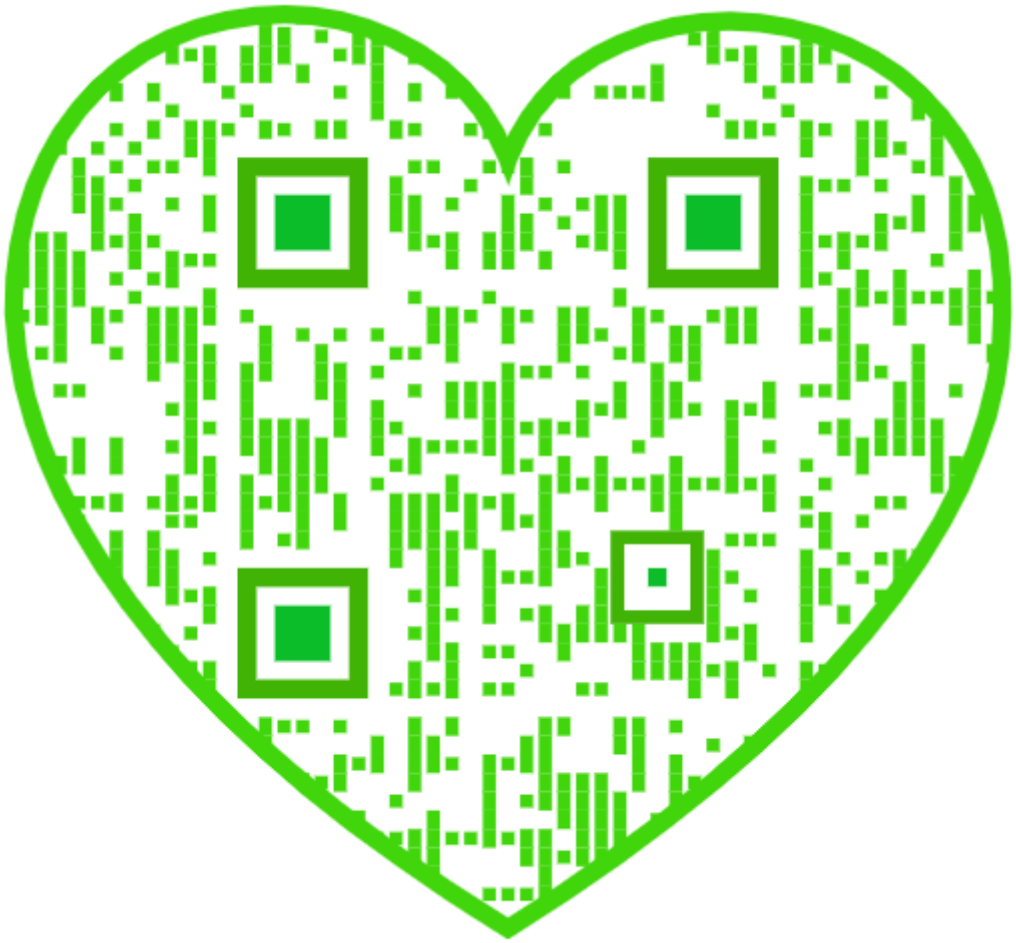
In June, 1891, the Rapid transit Commission of the city of Boston had been appointed to consider the question of passenger traffic as affecting the city. The commission gave fifty-one public hearings and expended

(Continued on page 204.)



THE EXCAVATING OPERATIONS ON THE BOSTON SUBWAY NEAR THE COMMON.

© 1896 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.
(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union 4 00

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement
(Established 1876.)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union *eight dollars and fifty cents a year.*

Building Edition of Scientific American.
(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Export Edition of the Scientific American
(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, post paid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, SEPTEMBER 5, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

African Island, a neglected..... 207
Alloys, new method for..... 202
Aluminum analysis..... 206
American Association meeting . 198
Ancient Greek statue, an*..... 207
Animals and geology..... 199
Aurora, the, and cathode rays*.. 203
Boston street car subway..... 197
Botanical gardens 199
Brooklyn's trial, the..... 199
Cathode rays and the polar corona*..... 203
Chemical Society, the American 206
Comets and cathode rays*..... 203
Delphi, bronze statue discovered at*..... 207
Eclipse of the sun, August 8 201
Electric lamp holder, an extension*..... 200
Electric street car subway, Boston*..... 197
Electrolysis and molecular dynamics..... 199
Explorers lost in South America 203
Guns, big, firing 205
Highways, power locomotion on 207
Horticulture and health..... 199
Li Hung Chang*..... 202
Lithography, centennial of..... 202
Mars, polar snow of..... 206
Milling machine, Van Norman's* 201
Moon, eclipse of the..... 209
Nansen's experiences..... 205
Newspaper censorship in Europe 200
Patent decisions, recent..... 206
Patent medicines..... 198
Peary, news from..... 203
Photographs, kite, of Boston.... 206
Princeton University, new library..... 207
Quicksand, testing*..... 200
Rifles, the Savage magazine*.... 200
Science, advancement of..... 198
Science notes..... 202
Smokeless powder, development of..... 206
Stars, six new variable..... 207
Steamboat record, North River. 201
Steamship, old, end of an..... 207
St. Helena as it is now..... 207
Street car subway, Boston*..... 197
Telemeter, Codeira's*..... 200
Trees, raising large*..... 204
Warship Brooklyn, trial of..... 199

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT No. 1079.

For the Week Ending September 5, 1896.

Price 10 cents. For sale by all newsdealers

PAGE

I. ANTHROPOLOGY.—The Emblematic Use of the Tree in the Dakotan Group.—By ALICE C. FLETCHER.—A valuable paper by a recognized authority, as read at the A. A. A. S. meeting, Buffalo, 1896.—First installment..... 17241

II. ASTRONOMY.—The Eclipse of the Sun.—Popular account of the recent total eclipse of the sun as seen in Norway..... 17241

III. CHEMISTRY.—The Quantitative Analysis of Metals by Electrolysis.—Simple apparatus for carrying out the above named process.—2 illustrations..... 17248
Uranium and its Properties.—Recent investigations by Becquerel.—A metal sensitive to X rays..... 17246

IV. CYCLING.—Akroyd's Cells for Pneumatic Tires.—A tire which can stand many punctures before deflation.—3 illustrations..... 17246

V. ELECTRIC ENGINEERING.—Double Crossley Gas Engine and Direct Driven Dynamo.—A direct connected gas engine and dynamo.—1 illustration..... 17247
Electric Lighting of Railway Trains Abroad.—The field of electric car lighting abroad.—A very full review of this subject..... 17248

VI. ENTOMOLOGY.—The Young Entomologist and What He Wants.—By SAMUEL H. SCUDDER.—An excellent practical article on the beginner's work in entomology.—The collection and preservation of insects..... 17240

VII. HISTORY OF SCIENCE.—Machine for Raising Water from a River to the Height of a Half Diameter of a Large Wheel, with but Slight Pressure.—A curiosity in the history of mechanics.—1 illustration..... 17246

VIII. HYGIENE.—Sunstrokes.—A theory of sunstroke and experiments to test its truth..... 17250

IX. METALLURGY.—Modern Methods of Iron Mining and Smelting.—By WILLIAM P. KIBBEE.—Notes on iron, iron ore and methods of working the same..... 17252
Note on Brass Casting..... 17254
The Art of Bronze Casting in Europe.—By GEORGE SIMONDS.—A very practical description of the methods of testing bronze statues.—First installment..... 17245

X. MISCELLANEOUS.—The Trouble in Crete.—An interesting article on Crete, its products and history; and story of the present crisis.—4 illustrations..... 17239
The Brussels International Exhibition of 1897.—Prospects of the exposition, with plans of the buildings and grounds.—1 illustration 17242
Visiting the Sewers of Paris.—A vivid description of the sewers of Paris, with illustrations and map.—7 illustrations..... 17250
Selected Formulæ..... 17252
Engineering Notes..... 17253
Electrical Notes..... 17253
Miscellaneous Notes..... 17253

XI. NUMISMATICS.—English Coins.—By G. F. HILL.—Early English, Scottish and Irish coins, with numerous representations.—1 illustration..... 17243
Note on a Recent Sale of Greek Coins in London..... 17254

XII. PHYSICS.—New Form of Apparatus for the Production of Roentgen Rays.—A new X ray tube giving powerful radiations.—9 illustrations..... 17254

XIII. RAILROAD ENGINEERING.—The Snaefell Mountain Railway.—An electric railroad operated on the Isle of Man.—Description of equipment and roadbed traversed.—2 illustrations..... 17247

XIV. SOCIAL SCIENCE.—An Industrial Democracy.—An interesting experiment by an American manufacturing company, establishing popular relations between labor and capital in their factory 17244

XV. TECHNOLOGY.—Milk and Some of its Products.—By JOHN CROWELL.—The quality of milk and the preparation from it of different products..... 17249
Open Hearth Furnaces in Glassworks.—The new type of furnace now used for the manufacture of glass, displacing the old pot furnace.—1 illustration..... 17251

PATENT MEDICINES.

The experience of every patent solicitor includes the preparation of applications for letters patent on mixtures designed to be used in medicine. The pharmacist, in his mercantile relations with the community, finds that a very large portion of his business consists in selling a quantity of well known ready-made mixtures, all of which by him are grouped under the term "patent medicines." These include the vast number of proprietary remedies for the cure of the ills which flesh is heir to, which remedies are of secret composition generally, and are frowned upon by the regular medical practitioners. Any one who for a moment considers the meaning of the term patent will see at once that it is grossly misapplied in the case of anything secret. A thing patented is a thing divulged. The medical profession very properly may raise objections to sundry secret medicines, as opposed to the ethics of their calling, but a medicine patented has its composition disclosed. Any one, for a nominal sum, can procure from Washington a specification describing its composition.

It would seem that it is not a departure from ethics for a physician to patent any medicine whose composition may involve the exercise on his part of invention.

Every physician has his own favorite prescriptions, and it would seem that the ground thus taken would expose the community to the abuse of being flooded with innumerable patents for medicines, and that prescription after prescription would become the property of some specific doctor.

But it so happens that the patent law, which may be treated from some aspects of the case as an embodiment of ethics, with numerous decisions of the highest courts of the land to elucidate its doctrines, steps in here and makes the patenting of a medicine exceedingly difficult. The history of these applications in the Patent Office is in most cases a rejection on formulated grounds. The application generally describes a mixture of well known medicines. In official letters from the Patent Office examiner in these cases apt descriptions and characterizations of these mixtures are to be found. The examiner will term the subject of the application perhaps "an inventory of items assembled regardless of synergistic effects or chemical union." The mixture may be stated to be "merely numerically novel," and as involving only the skill and ingenuity of a pharmacist or physician. The medicine, it will be stated, can be made by any one possessing the skill of the calling of a pharmacist or physician, and, therefore, is not the creative work of the inventor. The examiner will require the application to show, in brief, some new and distinctive product having new properties resulting from the compounding. This is rarely shown, and the application is rejected.

So much in line with each other do the numerous applications for patent medicines fall, that the Patent Office has adopted a fixed practice, that of rejecting all applications for medical compounds which can be regarded as in the nature of physicians' prescriptions, and as descriptive of mere assemblages of well known ingredients which have well known effects on the human system. The Patent Office has even gone so far as to use a practically stereotyped form of rejection of those compounds, emphasizing the fact that the proper subject matter of a patent, whatever it is for, must be able to endure the relative tests of the presence of invention as well as of novelty and utility. The majority of these cases are disposed of unfavorably for want of invention and for being mere aggregations of known things, not showing the required statutory elements. There is therefore no mystery attending the treatment of these cases. It will be seen that they fall exactly into line with applications for mechanical devices. In them, as in mechanical devices, one great proof of invention is the presence of a true combination of parts as distinguished from an aggregation. A distinctly new result must be shown. In a case of mechanics it is obvious that the showing a new result is far simpler than in the case of a medicine. The results of a medicine have to be demonstrated on so complicated an organism as the human frame, and the subjective element preponderates in the trial. In other words, the result produced depends largely upon the subject upon whom it is tried. It is therefore very difficult to prove the presence of invention by results. Even in mechanical cases this is often not the easiest thing to do, but when the human system becomes the subject, it is a hundredfold more so.

There is, however, an indirect species of protection open to the devisor of a prescription or a formula which is unpatentable. This protection is afforded by the trade mark laws. Under the provisions of this law he may register a trade mark in connection with his compound and thereby obtain standing in the United States courts for protection for the use of such title, prima facie evidence of which will be afforded by his letters of registration. Some trade marks are enormously valuable, the business energy of their proprietors having made a simple name worth many thousands of dollars. The right of protection in the use of a trade mark rests in the common law, but the registration of it by a competent patent solicitor of course immensely increases its value.

It is here that another frequent error is made. Many applicants imagine that a trade mark in some mysterious manner protects them in the use of a compound or preparation. This it does not do. It protects them in the use of the name or trade mark designation, and it is only indirectly that it can protect them in the thing bearing its trade mark, imitation of which might be shown to indicate a desire on the part of the competitor to copy the appearance of the article and hence to trench upon the trade mark.

The United States Patent Office is ready to grant letters patent for medicines which fulfill the statutory requirements. But in foreign countries this protection is often refused, the statutes forbidding the granting of patents for such compounds.

It seems clear that it may be considered an open question in professional ethics whether a physician should patent a remedy, assuming that he has one which is patentable. Synthetic medicines, prepared by chemical processes, often coal tar products, are now invading the field of Nature's simples, and it is possible that there may yet be a number of patentable medical compounds invented, to replace quinine and other vegetable alkaloids and extracts. But now, of all the so-called patent medicines, very few are really patented at all, and they are supposed to be, and often are, of unknown and secret composition. Protection by patenting, which involves disclosure of their composition, is the last thing their proprietors would think of. It is such secrecy that is opposed to every fundamental principle of medical ethics.

PROCEEDINGS OF THE AMERICAN ASSOCIATION AT BUFFALO, N. Y.

For the fourth time the city of Buffalo has opened her hospitable doors to receive the American Association for the Advancement of Science, and has given a hearty welcome to the hundreds of men and women who assemble to enjoy an interchange of the varied fruits of scientific research. The general session of the American Association for the Advancement of Science was opened on Monday, August 24, with prayer by Bishop Fowler of the Methodist Episcopal Church, followed by an address of welcome from General Jewett, the Mayor of Buffalo, and from Dr. Roswell Park, the president of the Buffalo Society of Natural Sciences. Attention was called to the fact that Buffalo was a great commercial center, more tonnage entering and leaving its harbor than any other in the world, with the exception of Liverpool. The institutions of this metropolis by the lakes were described, particularly the society represented by Dr. Park, and which is really doing an important work that reaches many thousands of people. This has been a famous year for conventions, especially of a political sort, a fact that caused the city aid to be denied that might otherwise have been expected. But public-spirited citizens amply atoned for this by their liberality. Prof. E. D. Cope, the renowned paleontologist and comparative anatomist, and who has the honor this year of being the President of the American Association for the Advancement of Science, responded to the addresses of welcome and gave an outline of the objects of the Association. He said that while many of the scientists assembled were teachers, the prime object of the organization was not teaching, but the advancement of science by the increase of knowledge; to penetrate the unknown; to understand with certainty the mutual relations of the various parts of the universe; and to ascertain the highest principles of nature. Some of us are attracted by a certain love of the beautiful, whether it be the beauty of perfect mechanism, of form, or of law in operation; others have an interest in the origin and destiny of the human race; others are adventurous explorers, while many others simply desire to know. Science has a high utilitarian value, and it also promotes human happiness. The man of science pursues the truth wherever it may lead, and often gains unexpected benefits. Scientific methods require a reasonable use of the results of observation and experiment. Thus correct habits of thought are formed; we study facts first, and then draw our inferences. Theories should not be valued for any more than they are worth. Labor brings its substantial reward, but there is a pleasure in activity itself. Scientific men teach that the mental life is worth living and gives as much pleasure as the physical life. They demand free thought, as well as thought that is careful and judicious and beneficial. The future of science will be greater than its past; and its honest, diligent cultivation will more largely affect the national life than it has ever done heretofore.

The address of Miss Alice C. Fletcher, before the Section of Anthropology, will be found in part in the SCIENTIFIC AMERICAN SUPPLEMENT.

Before the Section of Physics an address was given by Vice-President Mees on "Electrolysis and Some Outstanding Problems in Molecular Dynamics." He reviewed the history of the century that has elapsed since the first note was made of chemical action having been

© 1896 SCIENTIFIC AMERICAN, INC.

produced by electricity. Volta's great gift to the world was the voltaic battery, though his "contact theory" has been a barrier to the progress of investigation. Nicholson and Carlisle opened the field for the study of electrolysis by the decomposition of water. The substance decomposed is called an electrolyte; the battery terminals are electrodes, the one bringing the current being the anode, and the one carrying it away the cathode. Particles moving toward the anode are anions and toward the cathode are cathions, and the general law is that the electrolyte is split into two parts, and only two, no matter how complex its structure may be. The various theories propounded to explain this law were reviewed. Important experimental contributions have followed one another, batteries have been perfected, physical actions studied, measuring instruments invented. Faraday's laws were stated and his work reviewed rapidly. The contributions of Helmholtz, Thomson, Boscha, Favre, Gibbs, Hittorf and others were mentioned. Kohlrausch's work shows rare patience and skill. His law is that solution affects dissociation, and that in the case of fused substances heat is a factor to be considered. The question, Whence comes the electrical charge upon the ions? is not yet solved. Whether these charges are inherent in the molecule or whether they result from the work done upon the molecules in dissociation is not known. The determination of the relative values of solution pressures is simple, but of their absolute values difficult. It is impossible in this brief synopsis to do justice to Prof. Mees' statement of the various problems that remain to be conscientiously studied, but his concluding appeal is noteworthy, that American physicists should add their full share to the development of the theories which cluster around the one central pillar on which all science is built today, namely, the conservation of energy, and which is now more clearly defined and strongly intrenched than ever before.

Prof. William R. Lazenby, vice president of the Section of Social and Economic Science, gave an opening address on "Horticulture and Health." After a somewhat exhaustive treatment of the value of fruit as a diet, showing by means of chemical analysis and percentage tables what parts of different fruits go to build up the various compounds of the human body, he gave the results, from the pecuniary side, of many years' experience at the Ohio State University and elsewhere to show the practicability of a family's getting a good living from a small area of well located ground devoted to the raising of small fruits, flowers and forced vegetables. From the æsthetic side also, work in this direction is to be highly recommended, because the resulting close association with Nature in her most beautiful forms develops the best sides of character.

The socialist has his dream of an ideal world. He believes it possible to have a social and industrial order wherein all freely serve, and all are served in return; where no drones or sensualists can abide; where education is as free and common as air and sunshine, where nothing but service secures approbation and nothing but merit wins esteem; where mental development and moral culture is the aim, as well as possible attainment of all.

In conclusion the speaker said: "I sincerely hope that the obvious advantages of forming horticultural colonies will be widely and rapidly improved. It would correct the unhealthy congestion of our towns and cities. In no other way can so many be provided with homes, regular employment and good living. By a horticultural colony I mean the association of from one hundred to five hundred families in the purchase of a suitably located tract of land, embracing about one acre for each individual. The location, which should be reasonably near some large commercial center, and the purchase of this land, should be intrusted to the most capable and honest members of the association. It should be carefully surveyed and divided into a few small lots, centrally located, for the necessary mechanics and merchants, but mainly into areas of from one to ten acres for horticulture. Ample reservations of the best sites should be made for a schoolhouse, town hall and public park. The streets should be embowered with shade trees, and every owner of a lot or garden should be encouraged to beautify and adorn it.

"I believe such a co-operative effort would secure a modest but comfortable home for any family that could contribute from $300 to $500. If the contributions ranged from $500 to $1,000, a proportionally better home could be secured. Some of the advantages of such colonization over the isolated system of taking up a homestead may be summarized as follows:

"First.—One-tenth of the land required under the old system would be found abundant.

"Second.—It could be far better selected with reference to markets, and more suitable allotments for fruits, garden vegetables, floriculture, nursery, etc. could be made.

"Third.—Few draught animals and little expensive machinery would be required.

"And, finally, man's social and gregarious instincts would be satisfied.

"While ignorance and miseducation ruin thousands, I believe that poverty resulting from involuntary idleness sends more men and women to perdition than any other cause.

"Horticulture may never become a universal panacea for destitution and crime, yet I have a joyful trust that thousands will be awakened by it to a larger and nobler conception of the true mission of labor, and by its practice, along the path of simple, honest, persistent work, life may be made easier, and men and women healthier and happier."

"Botanical Gardens" were discussed by Prof. N. L. Britton, of New York City, in his opening address in the Section of Botany. He said that these were primarily formed for purely utilitarian objects, the chief being the procuring of plants for medicinal purposes. The function of such gardens as aids in scientific teaching and research, the one which at present furnishes the dominating reason for their existence, did not develop much, if at all, before the sixteenth century. The four main elements of the modern botanical garden have been brought into it successively and gradually. They are (1) the utilitarian, or economic; (2) the æsthetic; (3) the scientific; (4) the philanthropic. These elements have been given different degrees of prominence according to local conditions; some gardens being essentially æsthetic, some mainly scientific; while in our public parks we find the philanthropic function. The speaker dwelt on each of the four elements, showing how it should be developed in connection with an ideal botanical garden, and with due recognition of the other features mentioned. Then leaving the theoretical portion of his subject, he devoted the remainder of his address to a description of the main gardens of the world, illustrating his remarks by numerous stereopticon views. There are more than 200 so-called botanical gardens, but few of them meet the requirements now laid down. Some are pleasure parks with the plants labeled; most of them pay some attention to taxonomy and morphology; many to economic botany; while only a small number are admirably equipped in all respects. The United States contains ten such gardens, of which by far the best is that connected with Harvard University. The one established a year ago in Bronx Park, in the northern part of New York City, is one of the latest additions to the number. It is liberally endowed, and the plans for its development have been drawn on a broad basis. Through a co-operative agreement entered into with Columbia University, the herbarium and botanical library of that institution will be deposited with the garden, and most of the research and graduate work of the university will be carried on in the museum building.

Other vice-presidential addresses were: On the "Achievements of Physical Chemistry," by Prof. W. A. Noyes, before the Section of Chemistry; on "Intuitive Methods in Mathematics," by Prof. W. E. Story, of Worcester, Mass., before the Section of Mathematics and Astronomy; and on the "Artistic Element in Engineering," by Prof. Frank O. Marvin, of Lawrence, Kan.

The topic assigned on the programme to Prof. T. N. Gill, the vice president of the Section of Zoology, was "Animals as Chronometers for Geology;" but the renewed and lively interest in the ever troublous subject of nomenclature led him to take that as his theme instead. He was also induced by the fact that the last Zoological Congress held at Leyden had asked for the consideration of this important topic. Prof. Gill's address was an exhaustive review of the history of nomenclature, from the time of Linnæus, when 4,000 animals, exclusive of insects, were known, to the present, when there are 400,000 species of animals. The main heads of this admirable and extended treatise—for such it really is—were the following: The commencement of binominal nomenclature; the origin and significance of trivial names; whether the first species of a genus should be regarded as its type—the speaker saying decidedly that it should not be; as to the choice between names simultaneously published; the discrimination between families, super-families, sub-families, and groups; complaints as to the instability of nomenclature; his conclusion being that the "best thing to do now is to accept the current system, purified as much as possible by judicious and inexorably applied laws, hoping that in the future a less cumbrous system of notation may be devised." This will be a relief to those of us who have been perplexed and bothered with clashing scientific names, being now assured that we must put up with the present inconvenient nomenclature because it cannot well be helped.

Two public lectures, complimentary to the citizens of Buffalo, were given, with illustrations by the stereopticon. That on Wednesday evening was by Dr. J. W. Spencer, concerning "Niagara as a Time Piece," giving the eminent author's well known views and theories, to which ample space has already been given in these columns in reports of last year's proceedings of the A. A. A. S. That on Thursday evening, by Messrs. H. C. Mercer and Edward D. Cope, gave "The Results of Cave Explorations in the United States and their Bearing on the Antiquity of Man." A public reception was given, on Tuesday evening, by the ladies of the Twentieth Century Club and the members of the Buffalo Society of Natural Sciences, which was a most delightful social event, and enabled the guests and their hosts to form a mutual acquaintance with each other.

Reports of the special work done by the several sections, as well as of the various scientific excursions to Niagara Falls and elsewhere, will be given soon. Among modifications taken under favorable consideration is one for combining, in future summer meetings, the transactions of the chemical and the geological societies, and perhaps other affiliated societies, with their respective sections of the A. A. A. S., so as to prevent the duplication of work and complication of machinery of organization. The fact is plainly evident that some plan is necessary for managing with more system and fairness for all concerned the vast number of valuable scientific papers offered every year to be read in the nine sections now existing. Possibly the plan may meet with favor that is already adopted by the American Society of Civil Engineers, of publishing and distributing beforehand among the members the various papers accepted, and then having them brought up for discussion only. This might give more time for previous investigation and result in more thoroughly satisfactory conclusions. HORACE C. HOVEY.

The Brooklyn's Great Run.

The new cruiser Brooklyn, on August 27, proved herself to be very fast, by covering a distance of 83 nautical miles in a continuous run at an average speed of 21 92-100 knots. She also maintained an average of 22 9-10 knots during a portion of the run. This latter speed was accomplished in the run back between the third and fourth buoys, a distance of about 7 miles. She also, between the first and second buoys on the return, reached the high average of 22 48-100. In her run of 83 miles she had a boiler pressure of 160 pounds and an average of 138 revolutions a minute, with a maximum of 140 revolutions. By her performance she earns for her builders, the Messrs. Cramp, of Philadelphia, a bonus of at least $350,000, a premium of $50,000 being allowed by the government for each quarter of a knot developed in excess of 20 knots. Nothing is allowed for the extra fraction of a quarter of a knot, and, unless the computations of the official naval board should increase the average to 22 knots (which is not likely), the bonus will be no greater than if the Brooklyn had averaged 21¾ knots.

The vibration was scarcely felt by those on board at any time during the entire run, though the engines were, as a matter of course, worked to their highest tension throughout.

The course was marked by seven buoys, at each of which was anchored a revenue cutter or lighthouse tender. On these vessels were naval engineers, who took observations of the tide conditions, which will enter into the conclusions of the naval board in its report of the trial to the Navy Department. The following table shows the time taken and the speed made between the buoys:

Buoy.	Time.	Elapsed Time.	Speed. Knots.
1	10:45·13	....	....
2	11:04:17½	19:04½	21·70
3	11:23:07½	18:50	21·98
4	11:42:56¼	19:48¾	20·90
5	12:01:45¼	18:49	22·29
6	12:21:03¼	19:18	21·45
7	12:39:54½	18:51¼	21·96

Total elapsed time, 1:54:41¼; knots, 21·71.

Following is the record for the return course:

Buoy.	Time.	Elapsed Time.	Speed. Knots.
1	1:03:13	....	....
2	1:21:38½	18:25½	22·48
3	1:40:35	18:56½	21·87
4	1:58:56	18:21	22·90
5	2:18:23¼	19:27¼	21·28
6	2:37:00½	18:37¼	22·26
7	2:55:45	18:44½	22·08

Total elapsed time, 1:52:32; knots, 22·13. Grand total, 3:47:20½; grand average knots, 21·92.

The principal dimensions of the Brooklyn are as follows:

Length on load line, feet	400·50
Beam, extreme, feet	64·83
Draught, mean, normal, feet	24·00
Displacement, normal, tons	9,150
Displacement, trial, tons	8,150
Indicated horse power	16,000
Total coal capacity, tons	1,650
Coal carried on normal displacement, tons	900

This vessel has twin screws. The engines are of the vertical, triple-expansion type, four in number, two on each shaft, and in four watertight compartments. The forward engines are readily uncoupled from the after engines for cruising at low speed. The boilers are seven in number. Watertight bulkheads extend about twelve feet above the water line.

Berlin Suburban Traffic.

In 1891 fares were reduced about 50 per cent. The number of tickets sold has increased by 75 per cent, and the receipts more than 29 per cent. Very large crowds have to be accommodated on holidays, there having been nearly 1,000,000 passengers in one direction on Whitmonday.

© 1896 SCIENTIFIC AMERICAN, INC.

THE SAVAGE HAMMERLESS RIFLE—MODEL 1895.

The illustration represents a six shot repeater rifle of light weight, having all the latest improvements, the highest type of the modern gun, after every test has been applied, both to the mechanism and ammunition. It is the production of the Savage Repeating Arms Company, manufacturers of military and sporting rifles and carbines, metallic ammunition, smokeless powder, etc., Utica, N. Y. The sectional view shows the action closed, with reference letters referring to the following parts: A, the guard lever; B, the catch on the automatic cut-off; C, the automatic cut-off; E, the breech bolt; F, the extractor; G, the automatic carrier; H, the shoulder in the receiver for engaging the end of the guard lever for locking the guard lever when the gun is fired; K, the sear; N, the hammer or firing pin; O, the main spring; P, the sear screw; R, the trigger; S, the trigger safety; U, the breeching up shoulder; V, the bolt for locking the action; Y, the indicator hole for showing the position of the firing mechanism, to show whether the rifle is cocked or uncocked.

THE SAVAGE HAMMERLESS MAGAZINE RIFLE—MODEL 1895.

The projecting hammer has been entirely eliminated from the gun, in which either black or smokeless powder can be used, although the gun is specially designed to use smokeless powder without dilution. Four different kinds of ammunition are provided, ranging from the expanding bullet, for large game, to the miniature lead bullet cartridge. The action is easily dismounted and assembled, a new feature being the concentric arm of the finger lever, which at all times protects the trigger from being accidentally operated. The movement of this lever is short and requires but little power. The arm is a rapid firing magazine and single loading rifle, an automatic cut-off retaining the magazine cartridge in reserve when the arm is used as a single loader, and allowing a cartridge to be fed up into the chamber when one has not been placed in the breech opening. The change from a single loader to a magazine gun is always automatic.

The Savage smokeless powder is manufactured without the use of nitroglycerine in any form, and with this powder and the small caliber metal jacketed bullet an initial velocity of over 2,000 feet a second is obtained, giving a flat trajectory and affording a point blank range up to 250 yards. The barrel is also non-fouling, and hundreds of shots may be fired without it being necessary to clear the bore.

The Savage hammerless safety guard lever repeating military rifle has been selected and recommended after

AN EXTENSION ELECTRIC LAMP HOLDER.

exhaustive competitive tests at Creedmoor by the New York State Board of Examiners appointed by the Governor of the State to select and recommend the best type of magazine breech loading rifle for re-arming the National Guard of the State. The board, in making its report to the Governor, says: "We have also very critically examined a number of military magazine rifles in use in this country and in Europe of foreign invention, and are free to say that, in our opinion, all points considered, the Savage magazine rifle herein recommended is far superior in simplicity of construction, safety, durability, effectiveness, accuracy, beauty of outline, ease and certainty of manipulation, and for the double and ready use as a single loader or as a magazine gun, to any foreign magazine gun we have inspected."

Testing Quicksand.

Suppose we take a certain quantity of quicksand, dry it artificially, and then try to make it into quicksand again. Put it into a box and pour water on it carefully. Instantly the water is soaked up, and if we measure the volume, or better, the weight, of the sand, we shall see that it takes up a quantity of water that measures 30 per cent of its own volume, or 20 per cent by weight. The rest stays above the layer of sand. If we now pierce a little hole in the bottom of the box, we shall see pure water run out; the sand forms a kind of immovable filter. Also by turning the box upside down to see the sand keep its form like a stopper. It follows from this experiment that we cannot obtain quicksand in this way. We must reverse the condition of the experiment. Let us put the water into a vessel and sift in the dry sand in a thin stream, while shaking the vessel lightly. Then we shall get the thick but easily flowing compound known as quicksand. That the mixture may keep its mobility, two conditions are necessary: (1) The quantity of water contained must not be less than 21 per cent by weight. (2) The whole must be continually though lightly shaken. If we increase the proportion or interrupt the agitation for an instant, the mass settles down, retaining about 20 per cent of water, while the surplus, if it exists, rises to the top.—La Nature (Paris).

AN EXTENSION ELECTRIC LAMP HOLDER.

The simple and effective extension electric lamp holder shown in the picture has been patented by Eugene C. Kuenneth, Gustave Schreier and Charles Kuenneth, of Mount Olive, Ill. To the base plate on the wall is secured a strip with perforated angled ends to receive a pintle engaged by an arm formed in two parts, one of which is bent on itself to form a sleeve, the adjoining ends of the parts being perforated to receive a bolt by which the parts are clamped together by a wing nut. To the end of the other part of the arm is pivoted the first of a series of telescopic tubes, there being fillets between adjacent tubes, limiting their outward movement, and annular springs which hold the tubes in any position in which they may be placed. The holder may swing in any plane upon the pintle, and may be swung at right angles to this plane upon the bolt, being held at the desired inclination by the wing nut. The body of the holder is preferably of vulcanized fiber tubing, which is a non-conductor and about one-third the weight of metal, and the hinge, fillets and other trimmings are of brass, nickel plated, the fillets being threaded and screwed into the tubes. The rear portion of the holder is threaded where it enters the hinge cap, and the entire holder may be readily taken apart and quickly put together.

News from Peary.

A dispatch from St. John's, N. F., dated August 24, says that Lieut. Peary passed Turnavik Island, Labrador, early on July 20, in the steamship Hope, which was under steam and sail, ninety hours from Sydney. He reported everybody well and prospects hopeful. The vessel met considerable ice and numerous bergs along the coast. This news came by the Labrador mail steamship reaching St. John's August 24. Further news is expected by vessels returning from northern Labrador within the next fortnight.

Newspaper Censorship in Europe.

Those who enjoy the glorious privileges of freedom of speech, and freedom of thought and expression, within the realm of the States, will all the more readily understand and deplore the restrictions and censorship of the press in many of the countries of Europe, under autocratic and even constitutional government. Here is how things are managed in Austria, says the American Printer. In Austria every newspaper appearing more than twice a month has to deposit caution money if politics are treated or mentioned. For Vienna and surroundings this deposit is fixed at $9,000; for towns of 60,000 inhabitants, at $3,000; for towns of 30,000 inhabitants, at $2,000; and for all other places, at $1,000. By infringement of the press laws the caution money may be partly or wholly forfeited, and all fines are levied on the amount, which has again to be made up to the original sum if the papers are to go on. To facilitate governmental control, the printer of every paper has to forward copies of it to the local police, to the public prosecutor, to the chief of the local government, to the minister of state, to the supreme police department, besides supplying the imperial court library and the local court or national libraries. The publication of a paper can be stopped either by the police or by a court of law; but the transmission of foreign papers by the post can be prohibited by order of the minister of state. Moreover, the Austrian press has to submit to a stamp duty, abolished in Hungary, but not in the remainder of the empire, though many efforts have been made to obtain its total abolition, and this adds not only to the cost of the papers, but necessarily restricts the number of readers.

AN IMPROVED TELEMETER.

The illustration represents a simple, easily manipulated instrument for measuring distances, which has been patented by F. J. B. Cordeiro, Passed Assistant Surgeon of the United States Navy, of the United States steamship Constellation, Newport, R. I. Upon a handle so placed as to about balance the two ends of the instrument is an arm about three feet long, extended at right angles to a telescope, the end of the arm nearest the telescope having a graduation scale for either angles or distances. Rigidly mounted on the arm, coincident with the lower half of the field of the telescope, is a horizon glass, which is shown as a right angle prism, and pivoted to the outer end of the arm is a lever which extends under the horizon glass, and has an adjustable vernier coacting with the adjacent graduation on the arm. An index glass, shown in the engraving as a right angle prism, is rigidly connected to the pivoted end of the lever, its reflecting surface

CORDEIRO'S TELEMETER.

being at an angle of forty-five degrees to the axis of the lever. On looking through the telescope and horizon glass at an object when distance is to be measured, the lever is moved to cause the index glass to receive the image and reflect it to the horizon glass at a point coincident with the line of collimation. The angle will be determined by the vernier, and, the base line being known, the distance of the object may be readily computed or ascertained from prepared tables. If desired, the scale may be marked empirically for certain distances, which can then be read at once.

© 1896 SCIENTIFIC AMERICAN, INC.

AN IMPROVED MILLING MACHINE.

The milling machine in its various forms is rapidly taking its proper place in the modern machine shop. It has long been an indispensable tool in the tool room of every well appointed shop, and has been in quite general use for various special kinds of work. It is only in very recent years, however, that it has been demonstrated that for many kinds of work heretofore done on a planer or shaper a properly designed milling machine is a much more practical and economical tool. It is also a fact, not generally appreciated, that for surfacing and many other kinds of work, a face or end mill is a more desirable form and will give much better results than can be obtained with the ordinary forms cutting on the circumferential edge. Probably the main reason why the end or face mill has not come into more general use is because of the fact that it is difficult to hold work and bring it into proper cutting relation, using this form of mill on the type of machine most generally adopted, viz., the horizontal spindle type. Special milling machines are now being introduced, but the types that mechanics in general are most familiar with are: 1. Those with a fixed horizontal spindle, made in the plain and universal forms. And 2. The more recent type, with a spindle in a fixed vertical position. The horizontal type possesses some advantages over the vertical, and in like manner the vertical has decided advantages over the horizontal. It will be conceded that a machine which combines these two types, without sacrificing its efficiency in either position, will be a valuable addition to the list of machine tools.

The Van Norman "Duplex" milling machine, shown in the accompanying cuts, is an entirely new type of machine, which not only embodies the good points of both the horizontal and vertical types, but also has a range of movement and work that is not possessed by either of these. Reference to the illustrations shows a machine with a base and a work-holding table with slides very similar to the ordinary forms. It also has a main head frame with a large range of movement at right angles to the longitudinal movement of the work-holding slide or table. Attached to the main head frame in a vertical plane and parallel with the main head frame is the spindle or cutter head, which has a pivotal connection with the frame, so it can be set in any position between the vertical and horizontal.

The design and arrangement of the parts is such that extreme rigidity is obtained in whatever position the frame and cutter head is placed.

Fig. 1 shows machine with cutter head placed at an angle on the frame. Fig. 2 represents the cutter head in a vertical position.

There is hardly any limit to the variety of cuts that may be made with this machine. Work may be clamped on the table or held in a vise, and without releasing the work, the cutter or cutters may be brought to bear upon the work in any position between the vertical and horizontal. Bevel cuts can be taken with right-angled cutters, thus allowing a much larger variety of work with same outfit of cutters. Holes may be drilled in absolute alignment in vertical and horizontal position. The tables are arranged to give automatic feed almost the entire length, so that work may be secured on the full length of the table and the cutters brought to bear on same in either vertical, horizontal or angular position, thus rendering it a very valuable general manufacturing tool. The machine has a gear-driven mechanism, the cone being held in a stationary bracket with a splined shaft, attached to gear, passing through it, and moving with the main frame and head.

Charles E. Van Norman, president and manager of the Waltham Watch Tool Company, of Springfield, Mass., is the inventor and designer of the machine, which will be manufactured by the company. A variety of attachments for spirals and other special cuts can be used with the machine when desired, and a number of tools used in connection with the machine are shown in one of the views.

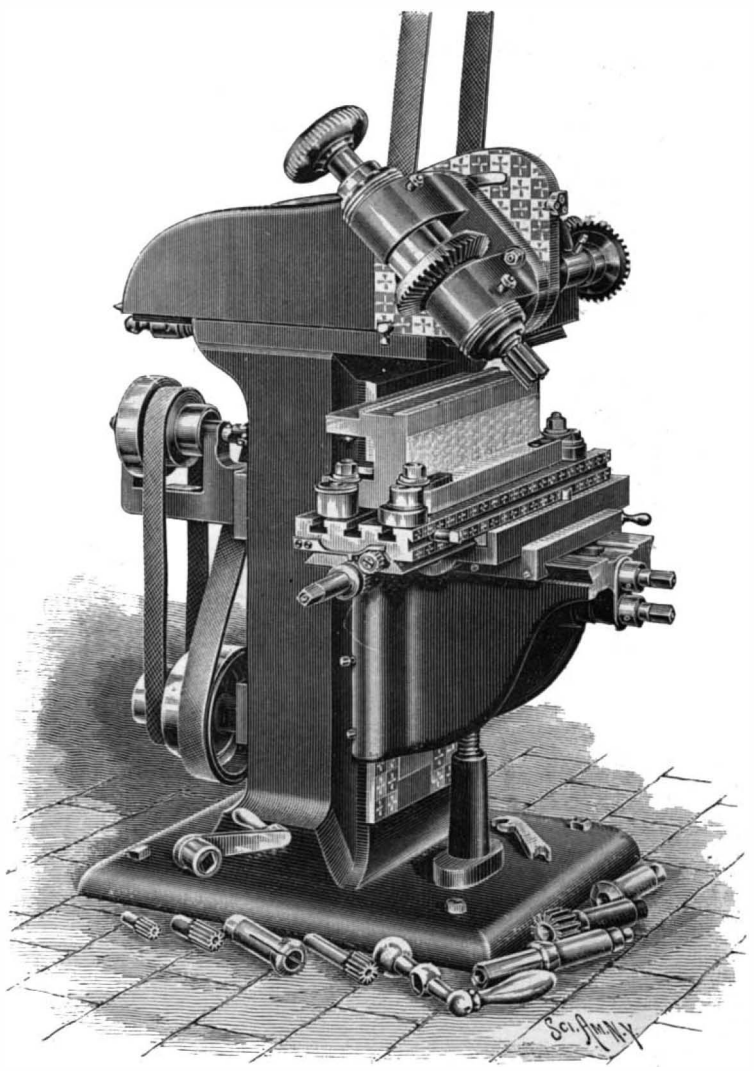


Fig. 1.

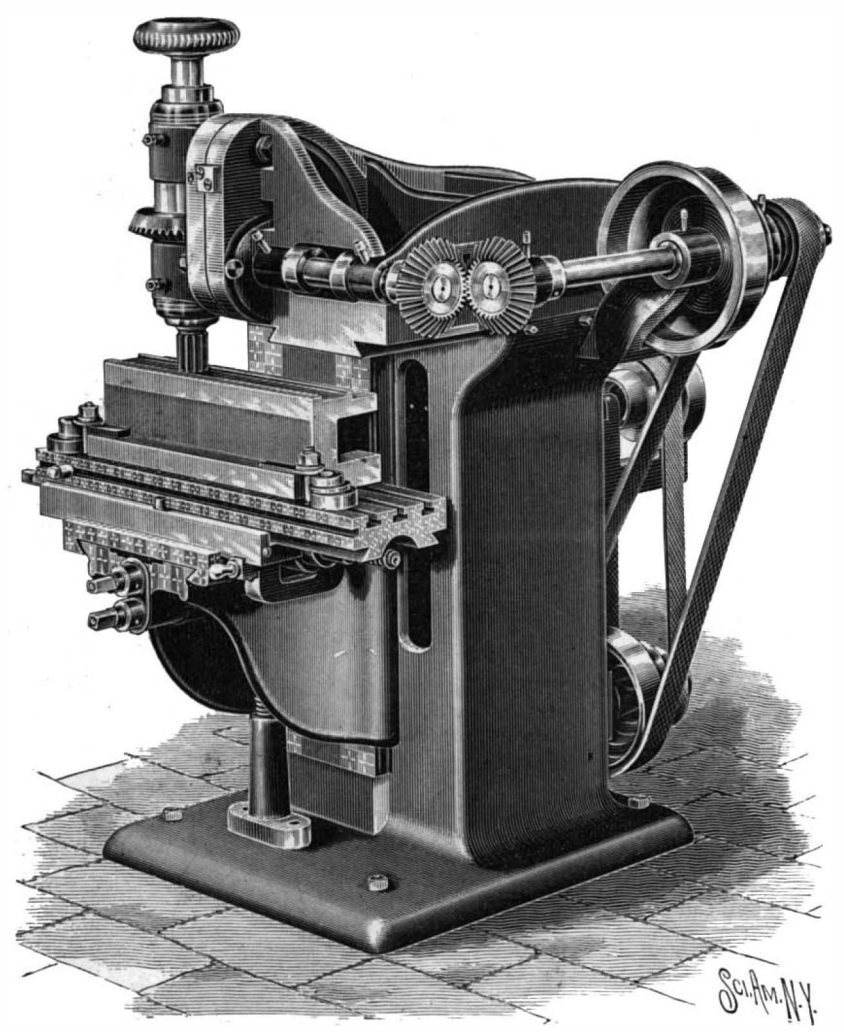


Fig. 2.

THE VAN NORMAN DUPLEX MILLING MACHINE.

The Eclipse of the Sun.

If it be true that science advances through failures, the clouds which prevented the observation of the total eclipse of the sun on August 8 may be a blessing in disguise. During the past quarter of a century, several astronomers have taken up the problem of discovering a means of photographing the corona in broad daylight, but the results have not been very encouraging. In the photography of solar prominences, Prof. Hale and Dr. Deslandres have obtained distinctly valuable pictures, and, were it possible to delineate the corona with the same success on any day when the sun is shining, our knowledge of the nature of that solar appendage would increase much more rapidly than it can at present, when the only opportunities for studying it are afforded by the brief moments of totality of a solar eclipse. Perhaps this latest experience will induce solar physicists to give further attention to the artificial reproduction of eclipse conditions. It is, of course, not suggested that every-day observations will make eclipse expeditions unnecessary—there will be work for astronomers during solar eclipses for a long time to come; but if it were possible to carry out systematic researches on the structure and constitution of the solar surroundings, instead of depending entirely upon the rare intervals when the photosphere is obscured, several moot points might be settled before the end of this century.

Observations of the recent total eclipse were made impossible by clouds. From all along the line of observers, the same report of foiled intentions has been received. At Vadso, and in the neighborhood, the sun was entirely obscured during totality, and no observations of scientific importance were obtained. The party of Russian astronomers who stationed themselves at the village of Orloffskoe, on the Amoor, were equally unsuccessful in making observations. The eclipse was visible as a partial eclipse at Tokio, but at Akeshi, in the island of Yezo, where the Japanese, American, and British observers had set up their instruments, the weather was wet and the sky cloudy, and it is reported that the preparations made ended in a fiasco. It is not definitely known what happened at Esashi, where Prof. Todd and Dr. Deslandres were stationed, but little hope of success is entertained. A telegram received at Copenhagen from Bodo, Norway, states that a photographer from Flensburg has taken eleven photographs of the eclipse at Bredvik, on the Skjerstad Fiord, but more details are needed before an opinion can be expressed as to their value. News has yet to be received from the British observing party at Nova Zembla, and from the expeditions of the Russian Astronomical Society stationed at Enontekis (Finland), the mouth of the Obi, and Olekminsk, on the Lena.

Mr. Norman Lockyer has sent to Nature the following telegram from Kio Island, where he established a station to observe the eclipse: "Although the sun was clouded during totality, the sight was most impressive. The darkness was so great that lamps were needed. The party from H.M.S. Volage consisted of seventy-seven observers all trained to make notes or drawings of particular characteristics of eclipse phenomena, such as coronal structure, extent of the corona, and the colors of sky, cloud, and land and water surfaces, and to take the times of contact. The party was also provided with spectroscopes for analyzing the lights of the corona and prominences, prismatic cameras for photographing the spectra of these objects, and polariscopes." With such an army of organized observers, an immense amount of valuable information would have been accumulated had the eclipse been visible. The exceptional opportunities for accurate observation offered by the presence of the Training Squadron gives astronomers reason for keen disappointment at the failure of the eclipse as an observable event; but students of science are used to the destruction of their hopes, and the next total solar eclipse will be as eagerly looked forward to as the one just hidden from them. —Nature.

The Steamboat Night Record to Newburg Broken.

The new night steamer Adirondack smashed her own and all night records to Newburg on August 22. She made the run of sixty miles in exactly three hours. Her previous best time was twenty minutes slower. A head wind and good flood tide were the conditions. The fleet Mary Powell holds all records on the Hudson. She has covered the distance in two hours and forty minutes. The propeller Homer Ramsdell and the Adirondack have a race up the river on alternate nights. The Ramsdell leaves New York an hour ahead of the Adirondack, but is compelled to make four landings. They reach Newburg within five minutes of each other.

THE receipts on the Kaiser Wilhelm Canal during the first year amount only to 1⅓ per cent of the capital invested in it.

© 1896 SCIENTIFIC AMERICAN, INC.

THE VISIT OF LI HUNG CHANG.

The man who in himself, more than any other single individual, represents the government of China, Li Hung Chang, is making this country a visit, in which great efforts are deservedly put forth to pay him high honors. He is seventy-four years old, and, although Viceroy of China, is traveling with a great suite under the title of Ambassador Extraordinary to Russia, from which country he is on his journey home by the way of England and the United States. He arrived in New York by the steamship St. Louis from Southampton on August 28 and was received with a salute of twenty-one guns, and the warships New York, Indiana, Massachusetts, Maine, Texas, Columbia, Newark, Raleigh, Montgomery, Amphitrite and Terror dipped their flags in his honor. He was met by representatives of the United States government and of the city of New York on the Dolphin, and a fleet of yachts and excursion vessels was present.

From the American line pier, Fulton Street and North River, the distinguished guest and those personally present to welcome him passed up Broadway in carriages to the Waldorf Hotel, escorted by the Sixth United States Cavalry. A number of receptions and visits of various kinds were arranged to entertain and manifest a hearty welcome to the distinguished visitor during a stay of four or five days in New York.

Li Hung Chang, although temporarily relieved of office and deprived of some of his honors during the war with Japan, is at present the great man of China again, as he was for many years before the war with Japan. He is Viceroy of Pe-cheelee, Senior Grand Secretary of State, Imperial Commissioner of Foreign Affairs, Senior Tutor to the Emperor, Director General of the Coast Defense of the North and of the Imperial Navy, Northern Superintendent of Trade, and Ambassador Extraordinary, thus being the chief manager of the home and foreign affairs and the army and navy of China. He is said to be enormously wealthy, but is a Chinaman to the backbone in everything except his appreciation of the superiority of American and European enterprise, which has caused him to utilize foreigners to educate his countrymen. Against bitter opposition he built such railways and telegraphs as China now has; tried to establish the army on foreign models, built an iron-clad fleet, and organized a system of coast defense, the failure of which in the war with Japan was due mainly to the stupendous corruption of his subordinates.

Li came originally from the Province of Anhui, where he graduated in 1847. In 1853 he fought the Taipings. From this time on fortune smiled on him. His name became illustrious in this memorable conflict, he was proclaimed as the savior of his country and obtained the famous yellow jacket. In 1854 he was named Taotai in the Province of Tonkin. In 1862 he was appointed governor of Kiangsu, superintendent of the treaty ports of the south and governor general of Hou-Kouang in 1867. Finally in 1875 he became premier, with the title of "Po" or noble of the third order. The presidency of the council of war and the direction of the navy devolved upon him. He is called, not without reason, the "Bismarck of China." He is tall and spare and his forehead is very fine. The eyes of the old man are still bright and his keenness of sight is remarkable. A drooping mustache and a small beard give him a military aspect. There is, however, nothing in this physiognomy, which appears so benevolent, to suggest the terrible conqueror of the Taipings.

From a Photo. by Russell & Sons, Baker St., London.

LI HUNG CHANG.

The Centennial of Senefelder's Discovery to be Celebrated.

In order to celebrate the one hundredth anniversary of the invention of the art of lithography by Alois Senefelder, a committee has been elected by the several lithographic associations existing to-day.

The celebration will take the form of an exhibition of all the different products of lithography. The exhibition will illustrate the history of the art from its birth to the present day. Specimens and prints from the earliest date and from all civilized countries will be shown.

Lectures on the history, progress, and development of the art will be delivered by well known experts in all of its many varied branches.

The committee has secured the spacious halls in Terrace Garden, at Fifty-eighth Street, New York City, for October 16 and 17, 1896. The celebration will be brought to a close with a grand ball. Joseph R. Keogh is chairman of the committee, and Ernst Lauckhardt, of 142 Kosciusko Street, Brooklyn, secretary.

In a recent memoir to the Paris Academy of Sciences, M. Moissan describes a new method of preparing alloys, especially of the refractory metals. He finds that by adding a mixture of the oxides of the metals and powdered aluminum to a bath of liquid aluminum, he is able to obtain alloys with molybdenum, titanium, tungsten, uranium, etc., the heat set free by the oxidation of the aluminum being sufficient to promote the reaction. Some of the alloys produced in this way may be found useful in the arts.

Science Notes.

On account of the recent important sales of coins, the English government has added $30,000 to the annual grant for the British Museum.

On the third of June, at Gottingen, the new Institute for Physical Chemistry and Electro-Chemistry was opened under the direction of Professor Nernst, the first of its kind which at a German university is devoted exclusively to the above branches of science.

Strangers who went to the Czar's coronation were astounded at the unpaved condition of Moscow. They found that it would cost $30,000,000 to pave the town, and that the work would practically have to be done over every year on account of the effects of the frost.

Photography has lately determined the depths to which the sun's rays can penetrate through water, and the result is that at a depth of 553 feet the darkness was about equal to an exposure on a clear but moonless night. The exposed plates at this depth gave no evidence of light action.

Aime Guinard has used calcium carbide in small pieces in hemorrhage. He believes that the results obtained are not due solely to the local effect of the lime set free by the action of the liquids of the tissues upon the calcium carbide, but that the acetylene liberated also has some therapeutic influence.

The Albert medal of the Society of Arts has been awarded to Professor D. E. Hughes, in recognition of the services he has rendered to arts, manufacture, and commerce by his numerous investigations in electricity and magnetism, especially the printing telegraph and microphone. Professor Hughes has our congratulations.

A curious lake has been found in the island of Kildine, in the North Sea. It is separated from the ocean by a narrow strip of land and contains salt water under the surface, in which sponges, codfish, and other marine animals flourish. The surface of the water, however, is perfectly fresh and supports fresh water creatures.

According to the New York Electrical World, Dr. J. C. Perry and Mr. W. C. Cheney, superintendent of the Portland General Electric Company, have been very successful in defining free gold in quartz by means of Roentgen rays. If this is so, it is evident that the definition of "visible gold" will have to be enlarged and the mining prospector will be worried with another new test.

An excellent property of aluminum is its sonorousness, says Electricity. According to Faraday's experiments, the sound of an aluminum bar is not limited to a single tone, with its corresponding upper tones, but there are two different tones audible, one in the longitudinal and one in the transverse direction. This may be easily observed by hanging a bar on a thread and holding it near the ear while striking it.

A delicate instrument, says Invention, has been designed by Mr. Horace Darwin which will indicate slow tilts and pulsations of the earth's crust of less than 1-300 of a second, or an angle less than that subtended by a line an inch long at a distance of 1,000 miles. It consists of a circular mirror suspended from brackets on an upright by two wires of very unequal length. Slight tilting of the upright causes exaggerated motion of the mirror, and the spot of reflected light moved half an inch when a finger was laid gently on the marble window set supporting the apparatus.

© 1896 SCIENTIFIC AMERICAN, INC.

ON THE COMPARISON OF LOW AND HIGH VACUUM ELECTRICAL AND RADIANT MATTER PHENOMENA WITH THE AURORA, THE SOLAR CORONA, AND COMETS.*

BY PROF. WALLACE GOOLD LEVISON.

A notable feature of the aurora is that its striking colors always occur in the same order.† When the streamers are fully developed they are invariably red below, green in the middle, and terminate in long reaches of a yellow color.

It seems quite positively established that the aurora consists of high potential electrical discharges reaching through every gradation in density of the terrestrial atmosphere, probably following approximately the lines of force of the terrestrial magnetic field, appearing more intense where they are concentrated near the poles, and being almost or quite invisible in equatorial regions, where they are viewed transversely and are distributed over a large area. Auroral beams have been seen to shoot between the observers on a vessel and cliffs upon a near-by shore, and even between the houses in a village. On the other hand, they usually attain a height of from 60 to 100 miles.‡ It has been calculated that at 62 miles in height the atmospheric pressure is not more than about two millimeters, and rapidly diminishes above that height.

An electrical discharge passing through nitrogen or air reduced to a pressure of a few millimeters affords the red glow or stratified appearance of the Geissler tube, while at a lower pressure of one millionth of an atmosphere more or less it affords the pale blue, pale green, yellow green, or bright green beam of light that is emitted normal to the surface of the cathode in the Crookes tube,§ and that is only faintly visible to the eye, but is very distinctly shown in my photographs of such tubes. This is perhaps the only electrical discharge that can be experimentally developed in the form of rays or beams and it is highly susceptible to the influence of a magnet.

Assuming the correctness of the theory that an auroral beam is such an electrical discharge directed through our atmosphere of graded density, it seems to me that the colors of the aurora may be explained as depending merely upon the degree of rarefaction of the atmosphere at the particular elevation where the particular color occurs.

It might be supposed that this explanation could be easily verified by the comparison of the spectrum of the auroral streamers with the spectra of various electrical discharges in vacuum tubes containing air or nitrogen at different degrees of exhaustion, but attempts to institute such comparisons do not appear as yet to have afforded conclusive results, for several reasons. For example it would seem desirable to examine the spectra of electrical discharges in rarefied gases free from confinement, a condition which we have no means of experimentally securing. It is, however, under such a condition, in a certain degree, that the aurora is developed.

As the solar corona resembles the aurora in presenting an invariable order of colors, it may be a similar phenomenon. Occurring as it apparently does in an atmosphere consisting chiefly of hydrogen below and helium above, it should present about the colors observed in the order maintained, and its extraordinary dimensions would be consistent with the extreme rarity of an atmosphere composed chiefly of the two lightest known elements.

Several theories of comets have been suggested, no one of which is generally accepted. For example, comets may consist, perhaps, of rays of illuminated or self-luminous gaseous matter, developed in a nebulous mass of unknown form more extensively as it approaches the sun, or the tail may be a form taken by the entire gaseous mass under the sun's influence. Again, a comet may consist of a swarm of small material bodies raised to incandescence and repelled by the sun in the form of the tail, the chief reason for the latter theory being that certain comets afford a continuous spectrum in addition to a bright line spectrum.*

Almost all such theories assume that the tail is repelled or illuminated or both by an electrical action of the sun, but no one has yet suggested just what kind of an electrical action would be competent to produce such an effect, or explained how it could be developed by the sun.

The only electrical phenomenon we can experimentally produce, which takes the form of luminous beams, is the high potential electrical discharge in attenuated gases, which would appear capable of producing a comet by the method suggested in the theory first mentioned. Why such an electrical discharge should emanate from the sun yet remains to be explained; but so also does the origin of the electrical discharge which gives rise to auroræ. Comparisons of the spectra of comets with the spectrum of such a discharge, as in the case of the aurora, and for somewhat similar reasons, have not yet afforded results at all conclusive, although we shall be able to make progress in such comparisons when we are visited by a sufficiently bright comet.†

Fig. 4.—PERRINE'S COMET, NOVEMBER 26, 1895. PHOTOGRAPHED AT LICK OBSERVATORY.

In other respects, the resemblance of the high vacuum discharge to a comet has been often noted. For several years I have been photographing such electrical discharges, and in my photographs of certain Crookes tubes the cathode beam appears to me to bear as close a resemblance to a comet as we could very well expect to obtain experimentally.

In the diagonal view of the Crookes tube (Fig. 1), for example, the cathode discharge is seen to consist of a cylindrical diverging beam, which appears to originate in a central area of the cathode plate, rather than from its entire surface. In the side view of the same tube (Fig. 2) the beam is seen to have a wing-like coma, surrounding the nucleus or head, and both views suggest that the beam would extend to a great length, were it not limited by the dimensions of the vessel. Where it is intercepted by the glass, it produces a patch of green light with a dark spot in the center, showing it to be a hollow beam. The dark central spot appears to be due to a protuberance where the end of the connecting wire is riveted in the center of the cathode plate, but of this I am not certain, as I have not tried a cathode plate without this central elevation. In color and general appearance the resemblance of this cathode beam to ordinary simple comets is at once apparent.

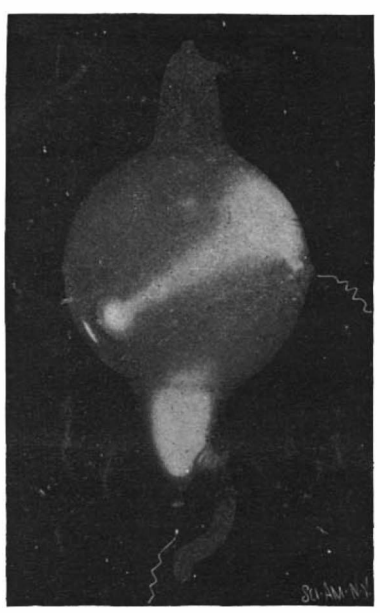


Fig. 1.—CATHODE BEAM IN CROOKES TUBE, DIAGONAL VIEW.

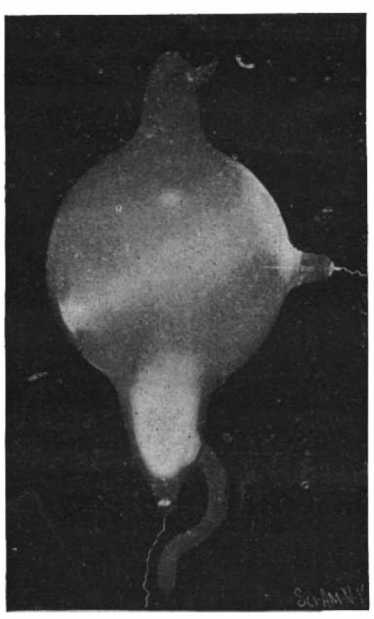


Fig. 2.—CATHODE BEAM, SIDE VIEW, SHOWING RESEMBLANCE TO SIMPLE COMET.

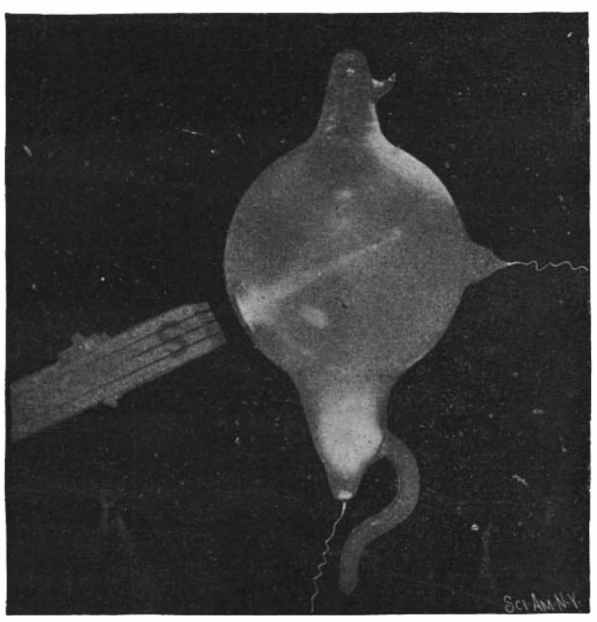


Fig. 3.—CATHODE BEAM BIFURCATED BY A MAGNET.

But the most interesting phenomenon presented by the cathode beam in this connection is its behavior under the influence of magnetism. By means of a magnet it may be caused to assume a variety of forms according to the position of the magnet with relation to the beam.

One example, shown in Fig. 3, a side view of the same globular Crookes tube with the poles of a compound U magnet presented behind the cathode, will serve to illustrate the susceptibility of the cathode beam to magnetism. The patch of green light upon the glass is largely moved from its original position and elongated, showing that the beam has flattened and assumed a fan shape. The extent of the deflection of the beam and its spreading and flattening depend upon the position of the magnet.

It will be further observed that the beam has divided in two parts. One preserves nearly the original direction normal to the cathode plate. The other and larger part is deflected and curved away from the first part, thus presenting a close resemblance to a second and common form of comets.

I have been able to procure for comparison but one photograph of a comet. This is shown in Fig. 4, and is a photograph of Perrine's comet, taken at the Lick Observatory by one hour's exposure from 4 h. 27 m. to 5 h. 42 m. November 26, 1895. It appears to closely resemble the magnetized cathode beam in Fig. 3. If this resemblance be not accidental, and be due to a common origin and cause, comets may be explained perhaps as follows:

Suppose a non-luminous nebula to arrive within the influence of the solar system or of the sun itself and be caused, by gravitation, to change its direction of motion from a straight line to an elliptical or parabolic orbit. Suppose that, as it approaches the sun, a high vacuum discharge is created within it by an electrical action of the sun in some way at present suspected but unknown. Such a discharge, taking normally the form of a conical beam of luminous ray, diverging slightly from a head or point of origin at the nearer side of the nebula, would appear as an ordinary single-tail comet, becoming more extensive and brighter as the nebula nears the sun. Suppose, however, that the sun be like the earth, a powerful magnet, and that the influence of its magnetism changes the form of the beam to some abnormal shape, depending on the position of the comet with relation to the sun's magnetic poles. If, for example, the comet approaches somewhere nearly in the plane of the sun's magnetic equator, perhaps the form would be that of Perrine's comet. If it approach nearly in a line with the sun's magnetic axis, it might at first appear in another form; but in passing around the sun in the plane of the sun's magnetic axis, it would assume several forms in pretty rapid succession, thus giving rise to such changes as have been noted in certain comets and appeared to be inexplicable. If this theory be tenable, the curves of comets' tails and all the rapid changes in form and dimensions of recorded comets may be perhaps attributed to their position at various times with relation to the solar magnetic axis, but it must be borne in mind that the magnetism of the various planets would also probably be concerned in shaping them. Having no facilities at present for properly pursuing the subject, it is my purpose in this note merely to anticipate a line of investigation which, it seems to me, is suggested by my photographs, and may assist in solving the problem of auroral, coronal and cometary phenomena.

* Abstract of a note read before the New York Academy of Sciences, May 4, 1896.

† Becquerel, Traite d'Electricité et de Magnetism. Paris, 1855, vol. iii, p. 442 et seq.

‡ Encyc. Brit., art, Aurora.

§ Crookes on Radiant Matter. Lecture before the Brit. Ass. Ad. Sci., August 22, 1879.

‖ The discovery of argon may assist in explaining some of the difficulties.

* This may prove to be a characteristic of the high vacuum discharge. See Crookes, Phil. Mag., January, 1879.

† Schellen, Dr. H., Spectrum Analysis. N. Y., 1872, p. 394.

American Explorers Lost.

The State Department has received from Consul Jastremenski, at Callao, Peru, a report regarding the rumored loss of an exploring party in the Inamburi River region, led by an American named Cooper. According to the report of the occurrence received here, the party, consisting of Cooper and seven others, after traveling for ten days along the Inamburi, lost all reckoning. For two more days they walked at random through the dense forests, and on the succeeding night were attacked by savages belonging to the numerous Campa tribe. The party fought with their rifles as best they could till, four of their number having fallen, two others, Germans, sought safety in flight. The American consul is investigating the occurrence.

© 1896 SCIENTIFIC AMERICAN, INC.

THE BOSTON ELECTRIC SUBWAY.

(Continued from first page.)

about $50,000 upon its work. In April, 1892, it made a report, containing various recommendations. The matter went over and a special committee was appointed by the Legislature of 1893. The new committee gave forty hearings and two acts were passed, one for the creation of a Metropolitan Transit Commission, another for a Board of Subway Commissioners. Without going into the details of the legislation, it is enough to say that, after various hearings by the committees, a composite act was passed by the Legislature providing for the incorporation of the Boston Elevated Railway Company and for the creation of the Boston Transit Commission.

Extensive powers were given the commission. They were authorized to build a subway or subways in the vicinity of the Common, to build a tunnel under Beacon Hill, to build a tunnel from the vicinity of Scolley Square, and to lay out a new way from a point near the southeast corner of the Common to Franklin Park. Seven million dollars was the limit of expenditure fixed by the act. The construction of a bridge over Charles River was also provided for in the act.

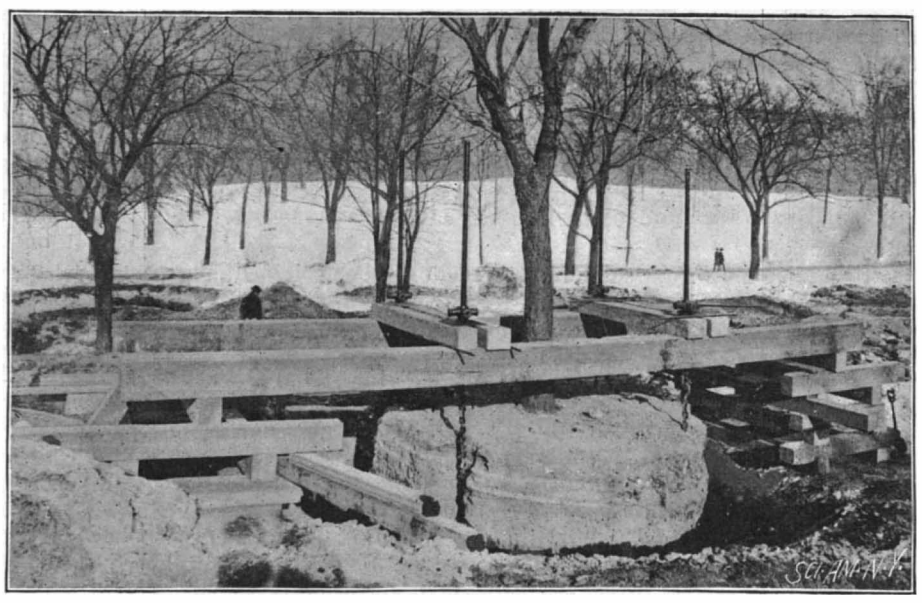
The commission at once began its work. By surface and subsurface surveys, the exact nature of the ground was determined, and these preliminary investigations included studies with regard to the disposition of underground sewers, pipes and conduits, that might be met with on the line selected.

It is interesting to note that an "alley" route was proposed. A twenty-five foot alley was proposed for construction in the space between Washington and Tremont Streets, in which it was proposed to concentrate all the street car traffic of the adjoining districts. There were various defects incident to this plan, such as the frequent grade crossings of the streets crossing the line, and the general inadequacy of a street of that width for the traffic of many lines of cars; besides which, the expense would have been very great. The plan, however, was submitted to the citizens of Boston in the election of 1893 and was rejected by them. The widening of Tremont Street, the placing of street car tracks on the Common and the use of a shuttle line in the more congested portion of the district were all discussed and considered only to be rejected, and the subway was finally and definitely chosen.

In our issue of August 31, 1895, we described in some detail the route to be followed and the general features of the construction. In order to have the tunnel near the surface, and in order to avoid lateral pressure, the arch type of construction is not used and the tunnel has been given a flat roof, supported by brick arches turned between heavy I beams. The sides are of similar construction, the I beams in the sides standing vertically. This establishes a number of arches both vertical and horizontal, each one of 6 feet chord, and of versed sine of about 9 inches. Diagonal struts connect the vertical and horizontal beams across the upper corners.

One of our cuts shows the Boylston Street entrance to the tunnel, near the Public Gardens, and its interior is the subject of another view. In excavating the ground at this point the contractors employed an advanced type of excavating machinery and conveyors. The aspect of the excavation work is illustrated in the large view.

PREPARING TO RAISE A TREE.



THE TREE RAISED TO ITS NEW LEVEL.

In excavating the line along the edge of the Common, the old graveyard was disturbed, and one of our illustrations shows the removal of the bones, which were consigned to caskets before reinterment. It is estimated that the bones of 910 persons, after their long rest close to Boston's busiest spot, were removed. Three ancient gravestones, giving a clew to the particulars of some of the old interments, were found, and views of them are reproduced. The remains are reinterred in another portion of the old burial ground, three small stones and a memorial tablet marking the site of their new resting place.

On Saturday before Christmas, 1894, a count was taken of the people taking the cars in the congested district, which shows that the maximum number leaving the cars at any one hour was nearly 3,500. This is used as the basis for determining the size of the station platforms.

The manipulation of trees on the line of the road presented many features of interest, and two of our cuts show the operation of raising a large elm tree. In this case it was merely a question of change of level, no transfer being required. The cuts are self-explanatory. A trench was dug around the tree, and the earth was then undercut, so as to form a great earth ball. Chains were passed beneath it and carried to four screw jacks, by means of which it was raised to the new level. The operation being done in winter enabled the engineers to secure a solid earth ball under the influence of frost, thereby greatly facilitating the work.

Our cuts illustrate a two-track subway. Part of it, however, will be wide enough for four tracks, side by side. The two-track subway is 24 feet wide, and the four-track one is 48 feet wide. The latter will have a line of steel posts along its center to take the strain off the roof. It is proposed to have the top of the rail about 17 feet below the street surface, so that less up and down stairs work will be involved on the part of passengers by it than in the use of the New York Elevated road.

The ventilation problem has been much simplified by the determination to use electric traction. It is proposed also to have a fan for every 600 feet section of the subway, of capacity sufficient to completely exhaust a section in seven to ten minutes. This gives a range of air current of from sixty to eighty-six feet a minute. The fans will work by exhaustion.

The cost of the two-track subway is put at $122 per linear foot; of the four-track subway at $132 per linear foot.

THE BOSTON SUBWAY—INTERIOR OF THE TWO-TRACK SUBWAY.

AN International Exposition of Precious Metals and Machinery used in mining and working them will be held in Brisbane, Queensland, in June, July, and August, 1897.

© 1896 SCIENTIFIC AMERICAN, INC.

Dr. Nansen.

The English newspapers have printed particulars of the strange circumstances under which Mr. Jackson accidentally met Dr. Nansen when traversing the ice pack on the southwest coast of Franz Josef Land. Jackson wrote:

"On June 17 I met Dr. Nansen three miles out on the floe to the south-southeast of Cape Flora, under most extraordinary circumstances. He had wintered in a rough hut within a mile or two of our northern limit in 1895, and this spring we unknowingly came to within a few miles of his winter quarters. It has been a great pleasure to me to be the first person to congratulate him on his great success.

"Our meeting was all the more remarkable as Nansen, owing to the great discrepancies in Payer's map, and to the fact that his two watches had stopped, was entirely uncertain of his whereabouts. He, on the other hand, was quite unaware of our presence in Franz Josef Land, and expressed the greatest surprise and the liveliest satisfaction in meeting with us. He and Scott-Hansen are both in thoroughly good health, and are rejoiced at the early prospects of their return home afforded by the presence of the gallant little Windward."

Nansen had actually started westward over the ice pack for Spitzbergen when Jackson met him. His project was not only highly dangerous, but was probably impossible of achievement, and it was his great good fortune that Europeans were there ready to succor him in bleak Franz Josef Land, where he had taken refuge.

Dr. Nansen went to Christiania on board Sir George Baden-Powell's steam yacht Otaria. A grand fête was held at Tromsoe before Dr. Nansen's departure in honor of himself and his comrades. Great enthusiasm was shown by the people, and Dr. Nansen and his comrades were carried in chairs into the hall where the fete was held and where a number of speeches were made lauding Dr. Nansen and his companions for their work. King Oscar II of Sweden and Norway will attend the reception to be given at Christiania to Dr. Nansen.

An invitation was telegraphed to Dr. Nansen asking him to address the annual meeting of the British Association, which will be held at Liverpool on September 16. A response has been received which justifies the hope that he will accept the invitation. His exploration resulted in many interesting scientific discoveries, and an account of his voyage is eagerly awaited.

The London Chronicle of August 27 publishes an account of the voyage of the Arctic exploring vessel Fram, after Dr. Nansen left her. The account is given by Capt. Sverdrup, commander of the Fram, and was sent to the Chronicle from Tromsoe by Dr. Nansen himself. The dispatch says:

"The ice pressure was never as severe as upon several occasions before Dr. Nansen left us. We were regularly exposed, however, to violent pressures, caused by the changing spring tides. The Fram was once or twice daily lifted from six to nine feet. Her bottom became visible as it rested on the ice. So little effect did this have on the Fram's timbers that the men slept undisturbed.

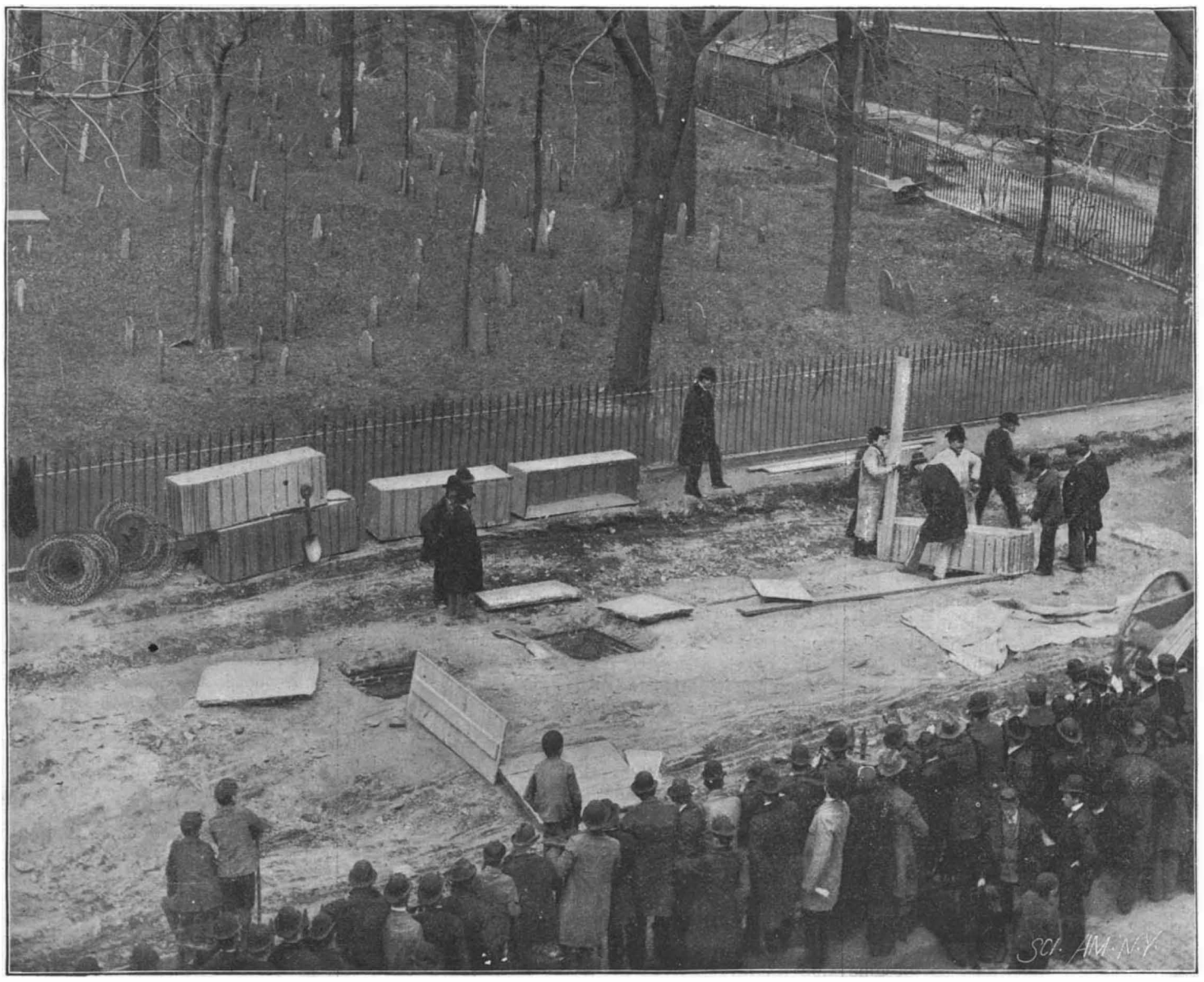
"An easier Arctic exploring expedition one could hardly imagine. The principal work was to take regular observations, sleep and eat. The health of the men was perfect during the entire expedition. There was not a sign of scurvy among any of the men. When all efforts to advance the boat through the ice by the force of steam or a process of warping failed, it was found that guncotton mines proved the best means of shattering the ice.

"As a rule there were very high ice floes, so extensive that their termination could not be descried even by the use of telescopes. Often it looked like a hopeless task breaking our way out of the ice foot by foot, but with the liberal use of explosives, and owing to the peculiar construction of our boat, we finally succeeded."

THE BOSTON SUBWAY—OLD GRAVESTONES FOUND ON LINE OF EXCAVATION.

Firing Big Guns.

Seven representative war vessels of the new United States navy arrived at New York, August 23, after twenty-two days of severe squadron sea service, which also included battery practice on a larger scale than had ever before been attempted on this side of the Atlantic. The squadron included the battleships Indiana and Massachusetts and the cruisers Columbia, New York, Cincinnati, Raleigh and Newark. It is said that the concussion from firing the thirteen inch guns on the battleships Indiana and Massachusetts was something terrific, and the shock on board the Indiana was such as to throw a 2,000 pound anchor several feet into the air and into the sea from her port bow. The target was about twenty-five feet high and fifteen feet wide at the base. The vessels of the squadron passed and repassed it at a distance of 2,000 yards, running about eleven knots. A spirited account of this practice is thus given in the New York Sun: "The New York led the column, and, as she got in range, she blazed away with her forward battery, following it up with a cannonade from her waist, and finally from the guns of her after division. Some of the projectiles from the big and little rifles pierced the wings of the canvas target. Any one of them would have hit the hull of an ordinary ship. The Indiana followed the New York, and the sea seemed to tremble with the vibration when her main battery let its ponderous missiles loose. Every gun on the port side barked or roared or thundered at the target. It was a new sensation to all hands, this firing of many guns from the decks of the greatest of our war vessels. The awful concussion made the men at the great rifles temporarily deaf; the niter from the powder blistered their faces, and powder grains more than an inch in thickness dropped on the decks, freckling them with holes more than half an inch deep. The 2,000 pound anchor flew from the bow as from a catapult with the thunder of the first gun. Capt. Bob Evans was too busy to stop to investigate the loss of the anchor; besides, the cruiser Raleigh was steaming at an eleven knot rate just astern, and, naturally, Capt. Bob kept right on, shooting off more gunpowder and steel as if nothing out of the ordinary had happened. Every vessel was cleared for action before she passed the target. That was the signal that fluttered in bunting from the flagship just before the seven white fighters formed in column to shoot at the canvas target. They were in the same condition they would be in if engaged in actual battle. Most of the shots of the Indiana struck so near the target that if it had been even a 200 foot ship there wouldn't have been a vestige of the ship afloat. The Raleigh, which followed the Indiana, holds the record for gunnery, not only in our own navy, but among all the war ships of the world. She maintained her glory by demolishing the target almost at the first fire, and the ships astern of her fired at a wreck. Rear Admiral Bunce signaled the Raleigh to put out a new target, which she did. Four times the ships of the squad-



THE BOSTON SUBWAY—INCLOSING HUMAN REMAINS PREVIOUS TO REINTERMENT.

© 1896 SCIENTIFIC AMERICAN, INC.

ron passed the target and four times they belched tons of steel that made the sea around the bobbing triangle look like an angry lot of breakers on a rocky coast. The Raleigh won the honors. Several times the signal, 'Well done, Raleigh!' was displayed from the flagship. Naturally Capt. Miller and Lieut.-Com. William J. Barnette, the executive officer of the Raleigh, were elated. From the Raleigh's main battery 207 shots were fired within eight minutes."

Subsequently the squadron indulged in torpedo practice. Buoys were placed a short ship's length apart, and at a speed of six, nine and eleven knots, each ship banged away with her torpedoes. The target was 400 yards from the ships, and each ship had three shots at it. Every torpedo didn't strike between the buoys, but every one would have hit an ordinary war vessel.

The American Chemical Society.

Buffalo Meeting, August 21-22, 1896.—The American Chemical Society, one of the societies affiliated with the American Association for the Advancement of Science, met at Buffalo, August 21 and 22, with an attendance of members nearly equal to the combined attendance of all the other affiliated societies, and with a long programme of papers, which included several of much importance. Dr. Charles B. Dudley, of Altoona, Pa., presided. The opening address of welcome was by Dr. Roswell Park, of Buffalo, as president of the Buffalo Society of Natural History, in which he said that that society now greeted the American Chemical Society for the first time, but hoped to meet them again in 1906, as they had met the American Association for the Advancement of Science in 1866, 1876, 1886, and were now to meet them in 1896. He said that it is not generally known outside of Buffalo that Buffalo is the sixth commercial city of the world, and in tonnage of freight entering and leaving the port it is surpassed only by Liverpool. He urged the chemists to devote their best energies to discover that great desideratum of therapeutics, some chemical compound which shall be toxic to pathogenic germs, but innocuous to the tissues of the human body.

President Dudley responded briefly on behalf of the society.

Dr. Park's address aptly introduced a very important paper in its sanitary bearing by Cass L. Kennicott on the "Inspection and Sanitary Analysis of Ice." Abstracts of other papers follow.

ALUMINUM ANALYSIS.

By James Otis Handy.

Although the aluminum industry is not a large one in the sense that the iron industry is, it is growing very rapidly. The output of the United States in 1894 was 550,000 pounds, and in 1895 it was about 850,000 pounds. The Pittsburg Reduction Company, with works at New Kensington, near Pittsburg, Pa., and at Niagara Falls, N. Y., is a representative American producer of aluminum. The material is made by electrolysis, in carbon-lined pots of alumina, the material being dissolved in a fused bath of fluorides. The product of each pot is ladled out at intervals, and is graded according to analyses. Some of the aluminum is sold as it is made and some is alloyed. The aluminum at present produced with the best ores available contains from 99 to 99·9 per cent of aluminum, 0·3 to 0·05 of silicon, 0·50 to 0·0 per cent of copper, 0·20 to 0·0 of iron. Carbon is sometimes present.

Second grade aluminum contains 96 to 98 per cent aluminum, silicon and iron making up the remainder. Aside from analyses of metallic aluminum, there are required in the pursuit of the aluminum industry analyses of aluminum alloys of copper, nickel, manganese, chromium, tungsten, zinc and titanium; of aluminum solders, containing tin, zinc and phosphorus; of aluminum hydrate, bauxite and electrode carbons; of hydrofluoric acid and fluorides. The method of these analyses was described in detail.

THE DEVELOPMENT OF SMOKELESS POWDER.

By C. E. Monroe.

Dr. Monroe gave an elaborate history of the work of other investigators and then described his own powder, called "indurite." To manufacture this powder he began by purifying his dried military gun cotton, which was done by extracting it with hot methyl alcohol in a continuous extractor, and when this was completed the insoluble, nitrated cellulose was again exposed in the drying room. The highly nitrated cellulose was then mixed with a quantity of mono-nitro-benzene, which scarcely affected its appearance and did not alter its powdered form. The powder was then incorporated in a grinder by which it was colloidized, and converted into a dark translucent sheet or mass resembling India rubber.

The sheet was now stripped off and cut up into flat grains or strips, or it was pressed through a spaghetti machine and formed into cords, either solid or perforated, of the desired dimensions, which were cut into grains. Then the granulated explosive was immersed in water boiling under the atmospheric pressure, by which the nitro-benzene was carried off and the cellulose nitrate was indurated, so that the mass became light yellow to gray, and as dense and hard as ivory, and it was by this physical change in state, which could be varied within limits, that he modified the material from a brisant rupturing explosive to a slow-burning propellant.

The indurite thus formed stood severe tests. The chief of the bureau informed Dr. Monroe, before the firing began, that a powder giving 2,000 feet initial velocity would be a complete success. In two successive rounds of a six inch rapid fire gun using twenty-six pounds of this powder, and a 100 pound projectile, the pressures were 13·96 and 13·93 tons, and the velocities 2,469 and 2,456 feet per second respectively.

Dr. Monroe sums up the desiderata of smokeless powder thus:

1. That it shall be physically and chemically uniform in composition.
2. That it shall be stable and permanent under the varying conditions of temperature and humidity incident to service storage and use for all time.
3. That it shall be sufficiently rigid to resist deformation in transportation and handling.
4. That it shall produce a higher or as high a velocity with as low a pressure as the service charge of black powder for a given piece.
5. That it shall be incapable of undergoing a detonating explosion.
6. That the products of its combustion shall be nearly if not quite gaseous, so that there shall be no residue, and little or no smoke.
7. That it shall produce no noxious or irrespirable gases or vapors.
8. That it shall not unduly erode the piece by developing an excessive temperature.
9. That it shall be as safe as gunpowder in handling and loading.
10. That it shall be no more than ordinarily dangerous to manufacture.

Indurite wrapped in felt in an iron vessel was exposed to a temperature of 208° Fah. for six hours without undergoing change, and again at a temperature of 212° Fah. for twenty-four hours before any change was observed, and again to 5° Fah. without being affected.

Edward Hart presented some notes on the preparation of glucinum, reporting progress in the investigation for which the A. A. A. S. some time ago appropriated a fund. He finds it better to handle large quantities, and has reduced beryl in quantities of 100 pounds at a time. The presence of silicon in crucibles first used impaired the purity of the product, and he substituted crucibles made of pure glucina, following the analogy of the reduction of aluminum, which is now made in crucibles of pure alumina. He described other details of his work, which is still in progress.

L. M. Dennis, in presenting a paper on "Some New Compounds of Thallium," mentioned incidentally that in the progress of investigating these compounds, he had discovered that potassium platino-cyanid, $K_2P+(CN)_4$, is by far the most efficient substance yet discovered to cause fluorescence of the X rays; hence is better adapted to paint fluorescent screens than any of the salts generally used. Prof. Dennis also read a paper on "Separation of Thorium from the Other Rare Earths."

Other papers read were: "Composition of Certain Mineral Waters in Northwestern Pennsylvania," A. E. Robinson and Charles F. Mabery; "Mercuric Chlor-thio-cyanate," Charles H. Herty and J. G. Smith; "Zirconium Oxalates," F. P. Venable and Charles Baskerville; "Rutheno-cyanides," James L. Howe; "The Reduction of Concentrated Sulphuric Acid by Copper," Charles Baskerville; "Some Analytical Methods Involving the Use of Hydrogen Dioxide," B. B. Ross; "An Analytical Investigation of the Hydrolysis of Starch by Acids," George W. Rolfe and George Defren; "The Effect of an Excess of Reagent in the Precipitation of Barium Sulphate," C. W. Foulk; "Estimation of Thoria, Chemical Analysis of Monazite Sand," Charles Glazer; "Determination of Reducing Sugars in Terms of Cupric Oxide," George Defren; "Acidity of Milk Increased by Boracic Acid," E. H. Farrington; "Accuracy of Chemical Analysis," Frederic P. Dewey; "Some Extensions of the Plaster of Paris Method in Blowpipe Analysis," W. W. Andrews; "Device for Rapidly Measuring and Discharging a Definite Amount of Liquid," Edward L. Smith; "Table of Factors," E. H. Miller; "A Modified Form of the Ebullioscope," H. W. Wiley; "A New Form of Potash Bulb," M. Gomberg, communicated by A. B. Prescott; "Morphine in Putrefactive Tissue," H. T. Smith, communicated by A. B. Prescott; "The Signification of Soil Analysis," H. W. Wiley; "A Complete Analysis of Phytolacca Decandra," G. B. Frankforter and Francis Romaley; "The Crystallized Salts of Phytolacca Decandra," by same; "The By-products Formed in the Conversion of Narcoline in Narceine," G. B. Frankforter; "Notes on the Determination of Phosphorus in Steel and Cast Iron," George Auchy.

On Friday afternoon the members of the society visited Lang's brewery and the city reservoir, and then separated into three parties, to visit (1) the Milson Rendering and Reduction Works and the Garbage Reduction Works, (2) the Aniline Works, (3) the Buffalo Reduction Company's Works (copper smelters).

On Saturday an excursion was made to Niagara Falls by boat and to Lewiston by the Gorge road. The Calcium Carbide Works, power house of Cataract Construction Company, and Cliff Paper Mill were visited.

RECENT PATENT AND TRADE MARK DECISIONS.

Loewer Sole Rounder Company v. Gibbon (U. S. C. C. Penn.) 74 Fed. Rep. 555.

Effect of Decision of Another Court Sustaining the Patent.—The decision of a Circuit Court sustaining a patent will be followed by another court unless new evidence is produced, which, if it had been introduced in the other court, would have resulted in invalidating the patent.

Sole Cutting Machine Patents.—The Loewer & Blair patent No. 407,735 has been held valid and infringed as to claims 1, 4, 5, 6, 9 and 14.

National Sewing Machine Company v. Willcox, Gibbs & Company (U. S. C. C. A. 3d Cir.) 74 Fed. Rep. 557.

Construction of a Royalty Contract.—The Willcox & Gibbs Sewing Machine Company agree to pay the National Sewing Machine Company a royalty of 40 per cent on its receipts from sales or leases of machines covered by the latter's patents, provided, however, that if the defendant "shall sell or lease or cause to be sold or leased" in any foreign country the machine at less rates than those in this country, "then the royalty rate to be paid shall be 45 per cent in lieu of 40 per cent as hereinbefore provided." After operating several years in the home market, the defendant began selling and leasing in a foreign country at a less rate. Plaintiff claims that the provision was retroactive, giving it a right, on the happening of the condition provided for, to 45 per cent of all previous sales and leases from the commencement of the contract. The Court held that the plaintiff was entitled to only 40 per cent of sales and leases prior to such operation in a foreign country at a less rate and 45 per cent of all subsequent sales and leases, both at home and abroad.

Kilmer Manufacturing Company v. Griswold (U. S. C. C. A. 2d Cir.) 74 Fed. Rep. 561.

Bale Ties.—The Kilmer patent No. 282,991 for bale ties of wire, where a bent wire is clutched in a V shaped clasp made of heavier wire, is void as to claims 1 and 2 in view of the patent of Smith, No. 159,463.

Codman v. Amia (U. S. C. C. A. 1st Cir.) 74 Fed. Rep. 634.

Atomizers.—The Shurtleff patent No. 447,064 is void as to claims 1 and 2 for want of novelty and invention, as there is no patentable novelty in securing directly to the cap or stopper of an atomizer a nozzle adapted to be applied to the nostrils, or in so constructing the cap or stopper that its top shall form a seat for the nozzle.

Campbell v. H. T. Conde Imp. Company (U. S. C. C. Ind.) 74 Fed. Rep. 745.

The Elements of a Combination Presumed to be Old.—A failure to separately claim any of the elements composing a patented combination raises a presumption that each of such elements is old.

Corn Planters.—The Campbell patent No. 324,983 for the combination of a planter and fertilizer distributer, consisting of a hopper having the rear portion inwardly curved in circular form and extending across both disks through which the corn and fertilizer pass, geared together for simultaneously dropping the corn and fertilizer, is void as being simply for a new collocation of old elements producing no new function, operation or result.

French v. Alter & Julian Company (U. S. C. C. Ohio) 74 Fed. Rep. 788.

Trademark.—A preliminary injunction forbidding the use of a trademark which has not been established by adjudication will not be granted if affidavits are filed that indicate a prior use.

Kite Photographs of Boston.

William A. Eddy, of Bayonne, N. J., has succeeded in making several distinct photographic views of Boston from a great height, by means of a camera supported from kites. The kites were of the tailless type used at the Blue Hill Observatory, where an altitude of 7,441 feet was obtained, and were six and seven feet in diameter. Four to eight of these kites were required to support the camera, depending upon the strength of the wind. Distinct views were obtained of the Common, Beacon Street, Commonwealth Avenue, Charles River, and the outlying suburbs, and Mr. Eddy estimates that in one of the views the camera was, at the moment of exposure, 1,500 feet above the pavement.

Andree Home Again.

Mr. Andree has arrived at Tromsoe, Norway, from Danes Island, Spitzbergen, on board the Virgo. He has abandoned, for this year, his idea of crossing the Arctic regions in a balloon, the season having become too far advanced to justify an ascension.

The Polar Snow of Mars.

A dispatch of August 24, from Lowell Observatory, Flagstaff, Arizona, to John Ritchie, Jr., of Boston, announces that the polar snow of Mars has been observed in latitude 75, longitude 36, about two degrees in diameter.

© 1896 SCIENTIFIC AMERICAN, INC.

Six New Variable Stars.

Lists of suspected variable stars are published in the Results of the National Argentine Observatory, vol. xvi, p. xxxii, and vol. xvii, p. xi. These lists contain 527 and 232 stars, respectively, in which the magnitudes were found to be discordant in the observations of the Corboda Durchmusterung. Especial attention is there called to 26 stars which are indicated by exclamation marks. These stars have been looked for on a number of Draper memorial photographs by Miss E. F. Leland, and the results confirmed by Mrs. Fleming. From this examination, confirmation of the variability of the stars —24° 12600, —27° 15203, —33° 185, —34° 224, —38° 138, and —38° 13089 has been obtained, the change exceeding one magnitude in all cases. The variation of —22° 13401, —22° 13700, —23° 8083, —24° 13621, —25° 1197, —30° 12799, —33° 13321, —35° 11936, —35° 14568, —37° 11462, —38° 2639, and —41° 12260 on from 8 to 25 nights did not exceed two or three tenths of a magnitude, and the variation of these stars is accordingly not as yet confirmed. In each of these cases two comparison stars were selected, differing about half a magnitude in brightness, one a little brighter and the other a little fainter than the suspected variable. The star —22° 15937 does not appear on photographs taken on 16 nights, although the adjacent star —22° 15939 is well shown on all. The confirmation by Miss Leland of the variation of —24° 7693 has already been announced (H. C. O. Circular No. 7). The confirmation by Mr. Robert H. West of the variation of —25° 1602, —26° 892, and 30° 375 has already been announced by him (Astron. Jour., xvi, p. 85). —25° 1602 and —30° 375 have also been confirmed here from the examination of the photographs. —30° 19092 is R Piscis Austrini. The variation of —33° 13234 was discovered independently by Mrs. Fleming (H. C. O. Circular No. 6). The star in the Bonn Durchmusterung —22° 4346 and not found by Thome does not appear on photographs taken on 8 nights.

It therefore appears that of these 26 stars, 12 are variable, the variability of 12 is not confirmed, and 2 do not appear on the photographs examined.

The laborious work of taking out all the photographs of the regions containing these six new variable stars, measuring the brightness, the magnitude at maximum and minimum, the period and form of light curve, as has been done for other variable stars discovered here, is now in progress. EDWARD C. PICKERING.

Harvard College Observatory, August 13, 1896.

Princeton's New Library.

Ground has been broken for the new university library of Princeton, N. J. The building will be about 200 by 180 feet, and will cover all the ground now occupied by the old chapel, most of that occupied by East College, and a big piece of the lawn back of East College. The new building is to be almost square, with a large court in the center. The plans and contract filed in the county records show that the new structure will be four stories high and will cost $598,000. Henry M. Potter, of New York City, is the architect, and the style of architecture is to be Gothic.

Besides the new library, a huge dormitory soon will be erected on the western part of the campus, and the faculty is to receive distinguished accessions. New fellowships and scholarships are to be founded. The old chapel has been torn down, and many of the ancient elms have also been removed to make room for the foundations.

Eclipse of the Moon.

Director E. S. Holden, of Lick Observatory, sends the following report of the partial eclipse of the moon on August 22. The observations were made by Professor C. D. Perrine:

"Light clouds partially obscured the first contact of the shadow, but they soon cleared away, and the sky was clear during the remainder of the eclipse. The first certain darkening by the penumbra was at 8:35.

"The first contact with the shadow was at 9:23:31. The last contact with the shadow was at 12:31:50.

"The obscured portion of the moon was quite bright, the more prominent markings being easily visible. The earth's shadow was a copper color near its center, shaded to a somewhat greenish tinge at the edges, the penumbra being of a light pink tinge."

A Bibliography of Power Locomotion on Highways.

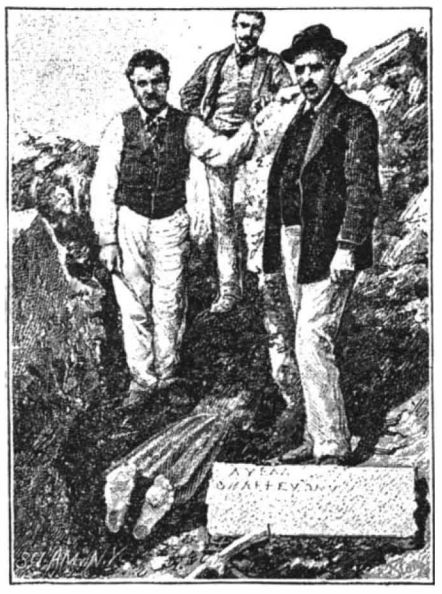
Mr. Rhys Jenkins, M.I.M.E., has conferred a real favor upon those interested in horseless carriages and traction engines by the publication of a guide to the literature relating to traction engines, steam road rollers, horseless carriages of every description, including books, papers read before technical and scientific societies, and periodical literature.

The latter is of the utmost value, the horseless carriage being so comparatively new. We note that the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT are referred to many times.

DISCOVERY OF A BRONZE STATUE AT DELPHI.

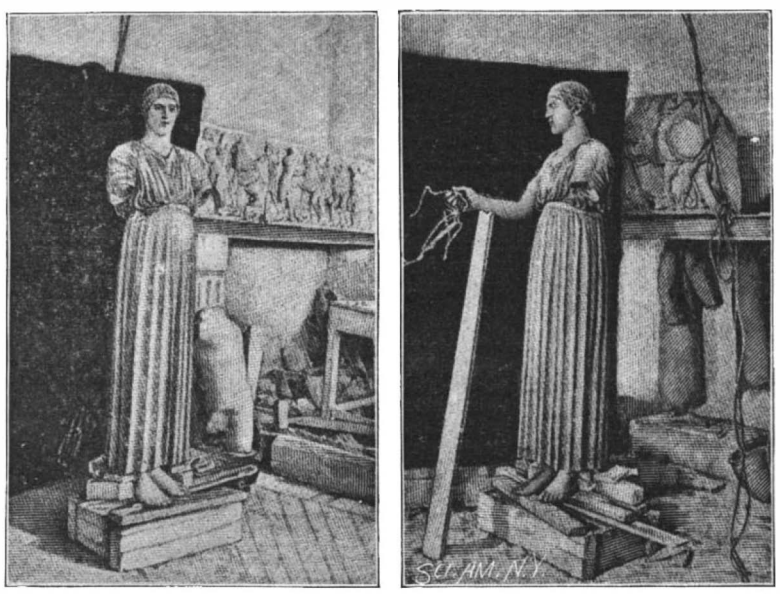
In the beginning of May, the lower portion of a bronze statue of natural size was discovered to the north of the temple of Delphi, behind a thick wall, at a depth of about thirteen feet, and above a sewer, as shown in our first engraving. The legs were covered with a long skirt, girt very high and extending to the ankles in symmetrical folds. The arrangement of the garment and the form of the elongated feet, with bony toes and projecting heels, indicate a work of the fifth century still marked by archaism. A break had occurred along the girdle at the point where the two halves of the statue were formerly joined, they having been cast separately and then soldered together. Aside from a small hole in the right side of the body, the piece was intact and in all the freshness of its patina.

The interior of the bronze was completely filled by a



FINDING OF THE STATUE.

compact core of blackish color that resisted the action of the knife as well as that of water, like earth that had been submitted to the action of fire at a very high temperature. The feet had been cast separately and affixed to this central core. Upon the researches being continued at this same place, there were met with in succession in an interval of a few days the following pieces: (1) A torso clad in a short-sleeved chiton, intact like the lower part of the body, and fitting accurately upon the waist. The composition of the fabric and naked parts and the proportions of the face agreed in style with the fragment already discovered and confirmed the hypothesis emitted as to the date of the work. The arms were discovered toward the middle of the biceps at the level of the sleeve, the folds of which concealed the joints of the forearms. A slight puff in the garment



BRONZE STATUE RECENTLY DISCOVERED AT DELPHI.

above the girdle served to hide the joints. (2) A forearm bent at the elbow and extending forward. The hand still held three loose bronze reins. This detail, along with the costume of the figure, which is that of the drivers of chariots, left no doubt as to the interpretation of the work. The statue represented an auriga —a conqueror in chariot races, one of the principal attractions of the Pythian games. (3) Several pieces of a chariot pole, around which the reins were wound; and of a yoke which rested upon the necks of the horses, along with the pads that supported it. (4) Three hind legs of horses and a shoe of a forefoot. (5) A right arm of the same work, but derived from a smaller statue.

There is no doubt that all these bronze pieces, found united, and all belonging to one and the same subject (the chariot race), all treated in the same spirit, at the same epoch, by the same processes and apparently by the same hand, relate to one and the same work. Such work is easy to restore in thought from the descriptions that Pausanias gives of the ex-voto addressed at Delphos or at Olympia by the rich trainers—the powerful princes who raced in the hippodromes and won the Pythian and Olympian crowns with so great honor. Standing in his chariot, not in the heat of the contest, but in the pride of triumph, the conqueror defiles at a slow pace. Above him floats the Victory that crowns him. At the sides of the chariot very young ephebes restrain the impatient horses.

This is the way in which we should figure the group, the auriga of which has been preserved to us. An attentive study of the figure and a comparison of the work with the Greek sculptures of declining archaism will permit of recognizing therein (1) traits common to the various schools that flourished between B. C. 480 and 460, such as the rounded form of the contours, the partly open mouth, the form of the feet, etc.; and (2) characters proper to the Peloponnesian studios. Whence the following conclusions: The work belongs to the fifth century B. C. (between the years 480 and 460), is of the Peloponnesian school and represents a group commemorative of a victory in the chariot races at Delphi. For our figures and description we are indebted to Tour de Monde.

A Neglected African Island.

Napoleon effectually prevented St. Helena from ever sinking into obscurity. Nevertheless, for some years past the island has been getting deeper and deeper into financial straits, while the population has been steadily diminishing. St. Helena is only some 1,600 miles distant from Capetown, and yet the island is comparatively unknown to South African colonists, as the outward and homeward steamers to and from Capetown only call there once in three weeks and make a very brief stoppage. And yet this historic island is well worthy of a visit, not only from its associations with the great Corsican, but also because it possesses, probably, the finest climate in the world. A constant southeasterly trade wind, straight from the pole, blows over the island, and sweeps away those germs of disease which lie latent in less favored spots. As a consequence, the longevity of the inhabitants is probably much greater than in any other portion of the globe. In spite of all this, and proximity of the island to the Cape, hardly a solitary Africander finds his way there from one year's end to the other.

So much in reference to St. Helena as a health resort. Now let me briefly refer to a matter that is of more vital importance. The strategical advantages of the island have been fully recognized by both naval and military experts, and the Royal Commission which was presided over by the late Lord Carnarvon recommended that it should be strongly fortified and constituted an important naval and coaling station for the vessels of the squadron within the Cape command. These recommendations have, however, not been carried into effect. Certainly something was done to improve the fortifications ten or twelve years ago, but the guns are now of an obsolete type, and the diminutive garrison maintained in the island is utterly inadequate to defend it. Moreover, though St. Helena is supposed to be a naval coaling station, the Admiralty maintain no coal supply there, the coal for the ships on the Cape and west coast of Africa stations being kept at Ascension, which does not possess even a solitary gun, but is a cinder heap upon which many thousands are annually wasted.

The defenseless condition of St. Helena is a matter that intimately concerns the South African colonies, and should engage their attention. The island is utterly unable to help itself. The opening of the Suez Canal ruined its prosperity; and ever since it has been drifting nearer and nearer to bankruptcy. The greater portion of its adult male population has migrated to the Cape, and the whole revenue of the island is now only some £6,000. There are only half a dozen officials, and the governor fills innumerable other offices, including that of chief (and only) justice. It is deplorable that Great Britain should allow one of its possessions to sink into such a condition of decrepitude, and especially an island which, lying in the direct route to the Cape, must ever be of considerable importance.—African Critic.

End of an Old Steamship.

The old steamship Dessoug, which was made famous by successfully transporting hither from Egypt the obelisk that now stands in Central Park, has been towed around to Cow Bay, Long Island, to be broken up for the metal that is in her. She was originally the British steamship Denton, and was built at Hartlepool, England, in 1864. She was 1,367 tons gross measurement and was an iron vessel. She had been in the Savannah line of the Ocean Steamship Company in late years, but had been laid up for some time and her class expired last autumn.

© 1896 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Engineering.

PUMPING POWER.—George W. Grimes, Bluffton, Ind. In a mechanism for pumping oil and water wells this inventor has devised a simple and compact construction, with the wearing parts easy of access and a strong frame, with supports of different sizes for connection with pump rods or lines, and easily and quickly regulating the length of throw of the rods or lines. The mechanism comprises a vertical shaft on which is eccentrically mounted a plate having an elongated hub portion engaging with the shaft and also having an upwardly extending angular flange engaged by a rod or line ring. The mechanism runs smoothly, without jerking or sudden pulls.

GENERATOR. — John J. Marchant, Rio Janeiro, Brazil. This is an apparatus more especially designed for use in boilers, blowpipes and other devices for generating steam and heat inexpensively and insuring a complete combustion of the fuel. A steam nozzle discharges into the front end of a tube, and a heat and flame producing device in the front of the tube causes the heat to be forced into the tube by the steam ejected by the nozzle. A very high heat is developed in the tube, which is utilized for generating steam and also for vaporizing oil for the blowpipe, the steam for the blowpipe being superheated. The desired flame, either pointed or brush-like, is obtained by distributing conveniently the oil or gas supplied by the valves.

STEAM RADIATOR FITTING.—Augustus Eichhorn, Orange, N. J. Improved means of introducing to the radiator the necessary steam, and permitting the return by the same pipe of the water of condensation, form the subject of this patent. In a three way fitting or union, one passage is connected to the single pipe of the steam radiator, while to the two remaining passages are connected the steam supply and water return pipes, the division of the steam and water being effected and maintained by the peculiar form of the fitting, and by curved ribs on its interior which form channels for leading the water to the return pipe and from the direction of the steam supply pipe.

Electrical.

WATER ALARM FOR TANKS OR BOILERS.—George V. Sheffield, New York City. This is a device for automatically sounding an alarm for both high and low water in a steam boiler or in a feed water tank, or in both. It comprises an alarm and electric circuit mechanism adapted to sound an alarm as to the level of water in the feed water tank, the engineer being notified to set the pump at work when the low water line is reached, and also notified when sufficient water has been pumped in, the device also sounding an alarm for high and low water in the boiler through contact wires fused in the glass water gage on the boiler, there being a circuit-closing float in the gage.

Railway Appliances.

CAR FENDER.—Frederic Reeve, Stockton, Cal. Near the front of the car platform, on its under side, according to this invention, are bearings in which is hinged a guard or scoop adapted to pick up a person or obstruction in the path of a moving car, this guard being let down by pressure on a foot lever by the motorman or gripman, and there being on a cross bar of the guard rollers adapted to travel on the rails when the guard is lowered. The guard is designed to be let down only when there is danger of some one being run over by the car, and is raised from engagement with the truck by a lever fulcrumed on the platform. Simultaneously with the letting down of the guard a framed net folded against the dashboard is automatically lowered to prevent any one from rebounding out of the fender net.

HOSE HANGER.—Benjamin S. McClellan, New Orleans, La. This invention applies to air brakes, the inventor having devised a simple and durable hose hanger to automatically hang up the hose and coupling when not in use, and close the coupling opening to render it dust proof, the hose being held in a natural position to prevent it from cracking. A flexible connection is affixed to the hose and positively connected to a spring-pressed drum attached to the car, there being means for automatically winding the drum, while a lever provided with a valve is adapted to close the opening of the coupling member.

Mechanical.

PRESS.—William T. and Ira E. Snowden, Hughesville, Pa. This invention is for an improvement in screw presses, whereby a quick adjustment may be made for different thicknesses of stock while retaining all of the advantages of the ordinary screw press. By means of a quickly applied and simple locking device the column carrying the follower, which is counterbalanced and has a sliding movement in the frame, may be adjusted and held against upward or downward movement, while the final pressure is brought to bear upon the stock by means of a screw. The press is of simple and strong construction.

PULLEY BLOCK.—Gregory M. Mullen, Baltimore, Md. In this block the main frame portion consists of a central plate with head and foot plates, shaft sections projecting oppositely from the central plate, and there being pulleys and balls on the shaft sections. The cap plates have central nuts for the outer ends of the shafts, and are lapped at their ends against the outer ends of the head and foot plates. The loose fitting of the balls in the rabbets of the pulleys forms a simple and compact construction in which the balls can be readily applied and removed, the balls projecting sufficiently from the rabbets to bear against the shaft and the frame.

COMBINATION TOOL.—Henry Hunt and Henry Hunt, Jr., Wilkesbarre, Pa. This is a strong and inexpensive tool, adapted to be carried about in the pocket, and designed to be especially useful to bicyclists, affording in one device an oil can, screw driver, and wrench. The handle portion, which is removable from the shank of the wrench, is hollowed out to form an oil receptacle, its tapering threaded neck fitting in a shank on which slides the movable jaw of the wrench, a screw driver or equivalent tool projecting from the outer side of the fixed jaw, to which it is removably attached.

Miscellaneous.

INCLINED RAILWAY AND WATER TOBOGGAN.—Stephen E. Jackman, Brooklyn, N. Y. This is an apparatus to enable persons to enjoy a continuous ride over an inclined or switchback road, through a tunnel, down a toboggan slide into a lake, and over it to the starting point. The car or boat has both track wheels and runners, with hand rails for the passengers to take hold of and dashboards to protect the passengers from splashing water. The tunnel is preferably covered with glass and illuminated by electric or other lamps, and the chute has a bottom of strips holding plates of colored glass below which are lamps, the water passing down the chute being broken up to form ripples by means of transverse strips. A large number of the vehicles may be sent over the course at one time, safety beams preventing displacement while going down the chute.

ORE SAMPLER.—Samuel I. Hallett, Aspen, Col. To facilitate obtaining accurate samples of ore this inventor has devised a machine in which a hopper feeds the material to a reciprocating or oscillating table from which it is discharged into separating boxes having each a number of compartments, some of which discharge into an outlet for rejected material, while others discharge into a feed pipe for the hopper of a second similar machine, with a series of separating compartments, the operation being continued through a series of machines until the desired sample is obtained.

GRAIN MEASURING DEVICE.—Nels A. Field, Lark, Iowa. This is a device which may be attached to any thrashing machine or wagon loader and placed at sufficient distance to be out of the dust, its position being changed according to circumstances. In combination with an oscillating measuring drum or device applicable to all sorts of grain as well as other loose commodities, is a detachable feed chute having a hinged lid, with a window or opening in its lower end, the lower end of the chute and the measuring device being connected by separable hinge sections and the upper end of the chute having a pivotal support. The capacity of the drum is varied according to the kind of grain to be measured, and the quantities measured are registered.

SELF-REGISTERING LUMBER MEASURE.—Henry W. Congdon, Weeping Water, Neb. To readily measure lumber of varying width and thickness, this measure has one or more driving or measuring wheels to be run over the width of the lumber and a series of length-gaged gear wheels held on he shaft of the other wheels, while a registering device has on its units shaft a series of gear wheels opposite the length-gaged gear wheels and a series of intermediate gear wheels meshing with the corresponding length-gaged gear wheels on the units shaft. The driving or measuring wheels have sharp teeth, and when they are passed across the lumber they revolve the shaft which actuates the gears.

TYPEWRITING MACHINE.—William B. Schwartz, Indianapolis, Ind. This inventor has devised an improvement in that class of visible typewriters in which the ribbon is held in front of the platen, and is stretched and carried close to or in contact with the platen at the moment a type bar strikes upon it. The ribbon is wound on two spools, one beneath the front of the flat top of the machine and the other below the platen, the ribbon passing through a flat tubular guide hinged to the inner edge of the top plate directly in front of the platen, and vibrated vertically by mechanism connected with the key levers. When the guide drops, it uncovers the letters or words printed, except one or more that may be momentarily obscured by the guide as it rises to allow the printing of a letter.

MUSICAL INSTRUMENT.—Louis K. Dathan, Brooklyn, N. Y. This invention relates to citherns, autoharps and similar instruments, and is designed to enable the player to execute with great ease, and facilitate the tuning of the instrument when required. A binding and tuning bridge is adapted to engage the strings between two parallel bridges to permit of tuning the strings belonging to an octave to one note or a single tone, and then applying the binding bridge and tuning all the notes simultaneously according to the scale.

FLOUR SIFTER.—Auguste F. Darras, Paris, France. Within a suitable casing, according to this invention, are arranged rotating vanes, brushes and sieves, the flour or other mealy substance to be purified first falling upon rapidly rotating vanes, by which it is carried into engagement with brushes and distributed upon a sieve, after passing through which it is received upon a sieve of finer mesh, finally falling through the lower ends of the drum and casing into a receptacle below. The invention is designed to facilitate the opening of the cellulose lumps and free the maximum of nutritious substances in the making of bread, pastry, etc.

HITCHING POST. — Isaac W. Lewis, Washington, D. C. This invention comprises a ground tube, to be permanently located in the ground with its upper end at or near the surface, this tube forming a receptacle for a post which may be drawn up and adjusted in stationary position for use as a hitching post, or the post may be pushed down into the ground tube and the top of the latter closed by a top plate and cap plate. The cap of the post has a ring, and just below the cap is an opening through which a rein may be passed. The post may be readily lifted to any desired height for use, when it will be firm and rigid.

TIP FOR WHIP STOCKS.—Thomas W. Bluett, Big Sandy, Montana. This is a metallic tip designed to replace the strip of buckskin or rawhide ordinarily used to attach the lash to the stock, and with this tip a broken stock or a worn-out lash may be readily replaced by a new one. This tip, which is tubular, is adapted to be screwed upon the stock, and has near its outer end two annular ribs which receive loosely a collar in which are secured the ends of a clevis which is preferably made of strong wire. The forward end of the clevis is bent to form a coil or eye, in which the lash is secured.

BUCKLE.—John C. Rosenkranz, Brooklyn, N. Y. This is a buckle for light work, such as suspenders, shoes, and other articles of personal wear. The buckle has a main frame with transverse central dish-shaped plate, and a clamping frame pivoted to one side of the main frame and capable of having the strap passed over it to draw the clamping frame down. The latter frame has a central transverse bar capable of moving over the space between the edge of the plate to clamp the strap.

GLOVE CABINET.—Edward A. Murray, Punxsutawney, Pa. To hold and exhibit gloves and similar articles so that they will be easy of access, this inventor has devised a cabinet which may be suspended from the top of a central post and revolved by slight pressure. It has drawers enough to hold a full retail stock, all the drawers being conveniently reached by the salesman, the drawers opening at one side and on one-half of each of the two other sides of the cabinet, and the walls of the other portions forming exhibition chambers.

CIGAR CLIPPER AND MATCH BOX.—Ysidro del Campo, El Paso, Texas. This is a box from which matches will be delivered with a regular feed, rendering it inconvenient for persons to carry away more than one or two matches. A gravity controlled feed roller communicates with the receptacle for the matches, the roller turning to deliver the matches separately to a receiver open to the customer. The cigar clipping device is operatively connected with the feed roller and moves in unison with it.

COMBINED TABLE AND BATH TUB.—William H. Link, New Richmond, Wis. This is an article of furniture designed to serve two purposes and yet occupy the space of but one article. Hinged to one of the legs of the table is a bath tub arranged to fold under the table, one leg and cross piece of the other end of the table being arranged to swing out of the way when moving the bath tub under or out from the table. The bath tub is supported on caster feet to readily roll over the floor.

BATH TUB. — George F. Butterfield, Stoneham, Mass. This tub has a gate hung on one side near its foot end to close the upper or head portion to the water supply. The bath tub may thus be readily divided to form a foot bath or children's tub, permitting of conveniently bathing children and saving a considerable quantity of water. On the side on which the gate is hinged is arranged a seat for the convenience of one taking a foot bath.

GAME APPARATUS.—Edward F. Buffat, Knoxville, Tenn. A circular box divided into compartments of various sizes has a flanged cover in which are openings to the compartments, a dome-shaped central portion of the cover covering the main compartment, and the dome surface having openings leading into different divisions and being made in two colors, each color embracing a subcompartment. The game to be played is called "politics," the different sized compartments representing ballot boxes and balls being used for ballots. Considerable skill is required to get the balls in some of the compartments, and the points counted are then proportionately higher.

ADVERTISING DEVICE.—Edward T. Gibson, Minneapolis, Minn. This is especially an improved advertising article, to be printed on a press, cut by dies, provided with creased or scored lines for bending, and shipped in flat shape to the party desiring to employ the article. The invention provides not only for bringing cut-out portions in relief against the background, but admits of the natural representation of such objects as a table, chair, box, desk, etc. A miniature theater is also provided, on the stage of which paper figures may be made to appear to act.

Designs.

OVERALLS.—C. E. Lightner, San Antonio, Texas. The leading feature of this design is for a front extension or centrally divided apron for garments of this class.

DISPLAY STAND.—Merritt A. King and Charles E. Mullin, Mount Pleasant, Pa. This stand has a central standard on which revolves a six-sided case, the sides of the body presenting a series of panels, and the shelves presenting an open work figure of radial arms.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

PRACTICAL RADIOGRAPHY. A handbook of the applications of the X rays. By H. Snowden Ward, F. R. P. S. London, England: Dawbarn & Ward. 1896. Pp. 80. Price 75 cents.

In preparing this book, Mr. Ward, as editor of the Photogram, has got together in readable shape all of the important facts it is necessary to know to construct a practical X ray apparatus. He was assisted by E. A. Robins and A. E. Livermore, who give chapters on the construction of the electrical apparatus. It begins with a history of the discovery, describes in detail the apparatus, accompanied by several illustrations, and ends with chapters on practical radioscopy, and applications and probable advances. It is a convenient book for those desiring practical information on this interesting Roentgen discovery.

THE OLD LIGHT AND THE NEW. Chemistry of color and new photography. By William Ackroyd, F.I.C. London, England: Chapman & Hall, Limited. 1896. Pp. 99. Price 75 cents.

Chapters I and II deal briefly on the nature of light, the chemistry and variations of color and their significance, while chapter III relates entirely to a description of the X rays, their numerous properties and characteristics under the title of "The New Photography." There are very good examples of X ray photographs the book. It is concisely written and gives data and facts in regard to the action of X rays on minerals, etc., that are of much value.

TAXIDERMY. How to collect, skin, preserve, and mount birds. The game and fish laws of the commonwealth of Pennsylvania. Illustrated. Pp. 128.

We have to acknowledge the receipt from Dr. B. H. Warren, State Zoologist of Pennsylvania, of his excellent treatise on taxidermy, which is illustrated with samples of the copper mounts and of methods of mounting, and containing full directions on skinning and preservation, with formulae, and to which the game and fish laws of Pennsylvania are appended. It forms Bulletin No. 6 of the Department of Agriculture, Division of Economic Zoology.

ALDEN'S LIVING TOPICS CYCLOPEDIA. A record of recent events and of the world's progress in all departments of knowledge. New York: John B. Alden. Price 50 cents.

We have recently had to review a portion of "Living Topics" The following volume brings out the fact that the editor's idea is to give mainly exclusively later topics and information in all departments of knowledge. It is contemporaneous in its distinctive value as a work, the ground taken by the publisher being that people studying a cyclopedia desire usually to acquire the knowledge of events that are of immediate interest. As soon as the alphabet is used up, it is proposed to begin with the alphabet anew, so that the succession of articles will furnish a thoroughly up-to-date review of all knowledge.

ELECTRIC LIGHTING. A practical exposition of the art for the use of engineers, students, and others interested in the installation or operation of electrical plants. Volume I. The Generating Plant. By Francis B. Crocker, E.M., Ph.D. New York: D. Van Nostrand Company. London: E. & F. N. Spon, 125 Strand. 1896. Pp. 444. Price $3.

This work is from the pen of Professor Crocker, long identified with the electric engineering industry of this country. He was a well known inventor and constructor years before he assumed the duties of professor of electrical engineering in Columbia College. We have from him the first volume of what promises to be a most excellent treatise on electric lighting. From all aspects, with the numerous illustrations, adequate indexes, and the characteristics of the author, it will, we believe, occupy an individual place of its own, free from all fear of usurpation. Professor Crocker's record at Columbia College has shown the value of placing a practical engineer in the professor's chair, and this work may be estimated a most valuable addition to the resources of the engineer and will still further advance the professor's reputation.

PUMPS AND PUMP MOTORS. A manual for the use of hydraulic engineers. By Philip R. Bjorling. Volume I. Pp. xv, 369. Volume II, Plates cclxi. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1895. Price $18.

The title page describes the scope of this book. It is a very exhaustive treatise on all the different methods of elevating water, starting from the ancient methods and giving elaborate treatment to the modern approved systems. The text consists partly of a very full description of the numerous cuts, whose number is testified to by the fact that the volume containing the cuts is thicker than the volume of text. All the cuts are of the mechanical order, being liberally lettered, so that the description of each as given in the text can be accurately followed by the reader. Nothing so complete on the subject has, we believe, been recently published. Although from the English standpoint, we do not find America neglected in the text, the honored name of Worthington receiving special consideration in the description of a test applied to one of his high duty pumps.

SPECIFICATIONS. A practical system for writing specifications for buildings. W. Frank Bower. New York: Edward A. MacLean. 1896. Pp. 229, ii. Price $5.

It is a common experience with those having supervision with contractors and builders that nothing is harder than to produce an adequate specification for complicated work, so that it manifestly is of value to obtain the ideas of others on the subject of similar work. The present volume presents the embodiment of a system of specification writing used by the author in his own practice for many years. The book hardly lends itself to review, but as covering all regular building problems, as well as electric lighting, electric bell hanging and other classes of work, it will be found to be of the greatest use to architects. The author states that it has already received warm appreciation from leading architects in the country. It is indexed and is quite free from anything like padding, and deserves warm commendation.

THE CENTURY ILLUSTRATED MONTHLY MAGAZINE. November, 1895, to April, 1896. New York: The Century Company. London: Macmillan & Company. New Series, Vol. XXIX. Pp. 960.

In an artistic binding, extending even to the fly leaves, with beautifully printed text, elegant paper and woodcuts and illustrations of its own high standard, this volume is an honor to American magazine literature. The Century among American magazines stands alone. It still, to its honor be it said, uses wood engravings and supplements half tone work by the engraver's tool. Its topics are most timely and they are treated entirely regardless of all considerations of expense. The magazine has maintained its price in the face of the low prices of the periodical literature which have occurred in the last few years, so that it rightly and properly occupies a position of its own, and certainly carries out the traditions established by the old time "Scribner," its predecessor. The present volume is particularly interesting, as containing the Napoleon articles which have attained such wide publicity with the authorship of Professor Sloane, of Princeton.

© 1896 SCIENTIFIC AMERICAN, INC.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

Marine Iron Works. Chicago. Catalogue free.

"U. S." metal polish. Indianapolis. Samples free.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

Construction of Machinery. H. G. Schramm, M.E., Camden, N. J.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Young men seeking a profitable business should investigate Ransome's system of concrete construction. 758 Monadnock Block, Chicago.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4, Munn & Co., publishers, 361 Broadway, N. Y.

Concrete.—See Kidder's new book on "Building Construction and Superintendence." Comstock, 23 Warren Street, N. Y.

Stay with your job, and with your wages pay installments for a profitable olive orchard. Booklet free. Whiting's Olive Colony, Byrne Building, Los Angeles, Cal.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6949) G. H. R. asks for formula for making developing cartridges for plates, or a strip of twelve exposures of pocket kodak film. A. Such prepared cartridges can be purchased from manufacturers of photo supplies. A dry mixture containing six grains of metol, twenty-four grains of sodium sulphite and ten grains of carbonate of potash dissolved in a large goblet of water, will make an efficient developer.

(6950) P. O. B. says: A battery having an output of 50 watts will light a 16 candle incandescent lamp when connected in series. Will the same battery light the lamp if connected in parallel, the output in watts being the same, but voltage is lowered and amperage increased. A. No. The lamp must have sufficient voltage to give a lighting current through its resistance.

(6951) S. E. Co. asks: Why should a thermometer rise when placed in front of a running electric fan? A. On account of the heat produced by the friction between the air and the bulb, and by the energy converted into heat by the arresting of the motion of the air. Other things being equal, the better the fan, the more the thermometer will rise.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 18, 1896,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Accordion, J. Galleazzi ... 566,269
Advertising device, electrical, J. J. McCormack ... 566,087
Aging machine, E. A. Rusden ... 565,927
Agricultural implement handle, W. C. Frick ... 565,887
Alarm. See Water alarm
Armature winding, S. H. Short ... 565,931
Atomizer, J. J. Bailey, Jr ... 566,282
Awning bracket, J. W. Richards ... 565,924
Axle box lid, car, Williamson & Schroyer ... 566,047
Bearing for wheels of vehicles, roller, A. C. Brownell ... 566,056
Bearing, thrust, P. H. Hutchinson, Jr ... 566,178
Bed, invalid and surgical, J. B. Young ... 566,114
Bicycle, A. Benson ... 566,053
Bicycle, S. E. Cleveland ... 565,880
Bicycle, Mackinnon & Gage ... 566,201
Bicycle, J. W. McIntire ... 566,275
Bicycle, C. J. Seymour ... 566,027
Bicycle attachment, H. Leineweber ... 566,083
Bicycle handle, adjustable, O. S. Erb ... 566,068
Bicycle lubricator, automatic, F. Della Torre ... 566,147
Bicycle support, W. K. Flatt ... 566,071
Bicycle support, locking, A. C. Saxton ... 566,023
Bicycles, etc., propelling mechanism for, T. Kerker ... 565,904
Blacking appliance, boot, A. B. Wyburn ... 566,264
Board. See Ironing board.
Bolt, J. M. & M. C. Bowers ... 566,130
Bolt heading machines, gripping toggle for, F. W. Bruch ... 565,877
Books, cover for memorandum sales slip, W. M. Kinbard ... 565,995
Boot treeing machine, J. Stewart ... 566,241
Bottle, non-refillable, C. A. Elliott ... 566,153
Bottle, siphon, R. Prax ... 565,922
Bottle stopper, M. N. Ellard ... 566,152
Bowling alley, J. N. Meyer ... 566,273
Box. See Lunch box.
Bracket. See Awning bracket.
Brake. See Car brake. Electric brake.
Brake beam, J. J. Casey ... 565,879
Brick kiln, H. J. Flood ... 566,157
Brick press, T. Whittaker ... 566,105
Bridge, compound truss, J. H. Semmes ... 566,233
Brush, fountain, J. S. Withers ... 565,950
Buckle, J. C. Rosenkranz ... 566,227
Buggy seat, J. P. Cooper ... 566,141
Cabinet, F. Norkus ... 566,010
Cabinet, automatic lock, E. W. Burns ... 566,135
Camera, roll holding, P. K. Stern ... 566,100
Can opener, H. Baldridge ... 566,265
Cans, hand protector for, W. Millen ... 566,085
Cap and stopper, combined, W. E. Andrew ... 566,121
Capsule filling machine, C. Schindler ... 566,098
Car attachment, W. J. Holmes ... 565,898
Car brake, W. S. G. Baker ... 566,052
Car brake, street, P. Flood ... 566,072
Car buffer, W. F. Richards ... 566,018
Car controller, electric railway, E. A. Sperry ... 565,939
Car coupling, H. C. Buboup ... 566,057
Car coupling, S. Grenier ... 565,977
Car coupling, G. E. Smith ... 565,934
Car door and running board, combination stock, Smiley & Cheek ... 566,029
Car fender, D. Hitchcock ... 566,174
Car fender, E. McCreary ... 565,914
Car fender, F. Reeve ... 566,225
Car fender, Washburn & Ferris ... 566,256
Car lighting, electric, W. J. Morden ... 565,913
Car or wagon, dumping, J. G. Holcombe ... 566,175
Car, railway, A. Bierstadt ... 566,127
Car seat construction, J. A. Brill ... 566,131, 566,132
Carrier. See Change carrier.
Cartridge crimper, paper, J. H. Barlow ... 566,126
Cartridge loading machine, L. G. Obman ... 566,217
Case. See Show case.
Cash register, L. Cooney, Jr ... 565,962 to 565,964
Cask heating and pitching appliance, J. Klein ... 566,192
Chain, G. L. Reenstierna ... 566,095
Chain and chain wheel, drive, Schaefer & Gray ... 566,230
Change carrier, J. W. Jones ... 565,903
Checkrein guide loop, E. D. Stansbury ... 566,033
Churn, J. W. & R. S. Matthews ... 566,084
Churn dasher, J. N. Hatcher ... 565,980
Cigar clipper and matchbox, combined, Y. del Campo ... 566,137
Cigar rolling machine, J. Bunn ... 566,058
Cigar vending machine, Tise & King ... 566,250
Cigarette blanks, apparatus for cutting, J. A. Bonsack ... 566,054
Cigarette machine, J. H. Dunn ... 565,967
Cistern-cleaner, F. Rightmyer ... 565,925
Clasp. See Hair clasp.
Clasp, C. R. Vinup ... 566,253
Cleaner. See Cistern cleaner.
Clothes line holder, W. P. Wheeler ... 566,044
Coal screen, B. E. Wightman ... 566,260
Conveyer, E. R. Draver ... 566,166
Cooking apparatus, steam, W. C. Salmon ... 566,228
Corn husking machine, W. T. Irwin ... 566,181
Corn sheller, W. C. Rowe ... 565,926
Coupling. See Car coupling. Hose coupling.
Coupling device, E. A. Sperry ... 565,935
Crate, banana, W. P. Burke ... 565,958
Cultivator, Harrington & Warnock ... 565,979
Cultivator, sulky corn, H. G. Thompson ... 566,248
Cultivator, wheel, W. H. Foote ... 565,886
Curling iron, hair, E. B. Jacobson ... 565,991
Currents, changing frequency of periodic, L. Gutmann ... 566,076
Currycomb, C. E. Ballain ... 566,124
Damper, stovepipe, F. D. Goddard ... 565,976
Dental apparatus, electric, H. F. Waite ... 566,103
Dental flask press, S. Mignault ... 566,207
Dental plugger, pneumatic, A. Pelham ... 566,220
Deoxidizing furnace, H. A. Jones ... 566,186
Desk lid support, B. E. Kipp ... 566,191
Detector bar clip, C. Hansel ... 566,078
Die hammering machine, C. H. Morgan ... 566,086
Display frame, garment, H. L. Welling ... 566,259
Door check, T. Curley ... 566,063
Door check, C. B. Harkness ... 565,896
Door hanger, W. McIntyre ... 565,915
Door or sash lock, portable, G. W. Haas ... 565,978
Door securer, A. N. Woodard ... 566,107
Door, sliding, Forbes & Hart ... 566,159
Draught equalizer, N. H. Nelson ... 566,008
Draught regulator, J. S. Fox ... 566,073
Drinks, apparatus for producing carbonic acid, Hauser & Bunzli ... 566,172
Drum, heat regulating, E. H. Donaldson ... 566,149
Dyeing apparatus, L. Weldon ... 566,258
Earthenware connection, W. M. Gilmore ... 566,074
Edged tools, manufacturing, W. K. Thompson ... 566,037
Electric brake, E. A. Sperry ... 565,937
Electric generator or motor, C. E. F. Ahlm ... 566,120
Electric machines, construction of dynamo, S. H. Short ... 565,930
Electrode for electrical apparatus, Schafer & Heinemann ... 566,231
Electrolysis, apparatus for indirect, E. Andreoli ... 565,953
Elevator. See Hay elevator.
Elevator car lock, automatic, R. C. Wright ... 566,109
Elevator locking attachment, W. C. Fahy ... 565,889
Elevator shaft door lock, M. W. Collet ... 565,882
Embroidering machine, E. & R. Cornely ... 566,061
Engine. See Gas or petroleum engine. Rotary engine. Traction engine.
Envelope fastener, E. A. Day ... 566,065
Envelopes, machine for fixing threads in, M. Grube ... 566,075
Evaporating pan cover, J. S. McCullough ... 566,005
Eyelet covering device, E. Kempshall ... 566,080
Fan concentrator, W. R. Marshall ... 566,000, 566,001
Farm gate, J. H. Norris ... 566,216
Feed water heater and purifier, T. T. Parker ... 566,219
Feed water heater, internal, J. J. Hogan ... 565,986
Fence crimping tool, wire, W. H. H. West ... 566,043
Fence fabric stretcher, P. & J. Sommer ... 566,031
Fence tool, wire, Tinsman & Ball ... 566,249
Fence, wire, J. McKee ... 565,916
Fencing, wire, M. T. Deck ... 565,966
Fender. See Car fender.
File, letter, W. A. Cooke, Jr ... 565,961
Filter, W. M. Fowler ... 565,890
Filter, multiple, W. M. Fowler ... 565,972
Fireproof floor, Kinkele & Wolff ... 566,189, 566,190
Fish scraper, O. C. Mackiett ... 565,999
Float, F. & F. H. Engelhard ... 565,885
Flue thimbles, device for closing, J. Sturgiss ... 565,941
Fluid, apparatus for delivering measured charges of, Schutte & Vogt ... 566,025
Frame. See Display frame.
Frogs, etc., foot guard for, F. F. Roberts ... 566,096
Frying pan, J. J. Reutlinger ... 566,226
Furnace. See Deoxidizing furnace. Heating furnace.
Game apparatus, E. F. Buffat ... 566,134
Game board, Austin & Craw ... 565,954
Garment, bicycle, E. F. McCartney ... 566,004
Garment hanger, A. Steinmann ... 566,034
Gas burner, C. W. Buffington ... 565,878
Gas lights, process of and material for manufacturing hoods for incandescent, W. L. Voelker ... 566,040
Gas or petroleum engine or motor, B. Wolf ... 566,263
Gas tube tip, A. Caldwell ... 566,136
Gate. See Farm gate. Railway gate.
Gate, W. R. White ... 566,104
Gate, G. Yellot ... 566,112
Generator. See Electric generator. Steam generator.
Generator, J. J. Marchant ... 566,203
Golf stick, H. R. Sweny ... 566,101
Grate, J. Reagan ... 566,093
Grate for furnaces, etc., F. P. Fuller ... 565,888
Grate for marine or other boilers, shaking, J. Reagan ... 566,094
Gun, automatic rapid firing, I. E. McAboy ... 566,214
Gun swab, J. F. Warner ... 566,041
Guns, cartridge for quick firing, D. M. B. H. Cochrane ... 566,138
Hair clasp, W. B. Emmons ... 565,884
Hame fastener, D. E. Copp ... 566,142
Hammer, drop, F. Lombard ... 566,199
Hammer oil guard, drop, C. E. Billings ... 566,128
Hammock, L. E. Irish ... 566,180
Handle. See Pail handle.
Hanger. See Garment hanger.
Harrow, rotary, A. Sewerson ... 566,234
Harvesting machine, J. M. Doddridge ... 565,883
Hat brim curling apparatus, W. H. Blackwell ... 565,956
Hat holder, H. W. Rose ... 566,011
Hats, crease retaining device for, P. S. Dusenbury ... 566,267
Hay elevator or carrier, R. W. Iliff ... 565,990
Heater. Seed Feed water heater.
Heating furnace, F. E. Browne ... 566,133
Heating system, hot water, W. H. Hallowell ... 566,077
Hinge, A. S. Held ... 565,983
Hitching post, I. W. Lewis ... 566,196
Hoop setting or driving machine, M. Naughton ... 566,006
Hop picking machine, S. Hemingway ... 566,173
Hop twining mechanism, R. Parrish ... 565,092
Horseshoe, Chilcote & Leffler ... 565,960
Horseshoe, C. F. Roper ... 566,020
Horseshoe, marsh, G. A. Randall ... 566,017
Horseshoe, nailless, J. McGurn ... 566,089
Hose coupling and stop valve, combined air, S. R. Heidelberg ... 565,981
Hose supporter, E. F. O'Brien ... 565,920
Ice into cubes, apparatus for cutting block, H. Vander Weyde ... 566,038
Ice slabs, apparatus for branding, H. Vander Weyde ... 566,039
Injector telltale and indicator, T. M. Eynon ... 566,154
Ink receptacle, F. G. Neubert ... 565,917
Insufflator, G. W. Moore ... 566,212
Insulation protector, G. B. Damon ... 566,064
Insulator for electrical purposes, Whitaker & Treharne ... 566,045
Insulator support, C. P. Toward ... 565,944
Iron. See Curling iron.
Iron derivatives of albumen, obtaining, O. Schmiedeberg ... 566,280
Ironing board, M. Patterson ... 566,276
Jack. See Lifting jack.
Joint. See Rail joint.
Journal bearing, H. Hubbard ... 565,988
Journal bearings, means for laterally adjusting, Goodell & Pyott ... 566,166
Kiln. See Brick kiln. Lime kiln.
Knitting machine cam mechanism, J. W. Rist ... 566,019
Lamp, electric arc, H. J. Fisher ... 565,971
Lamp, electric incandescent, F. M. F. Cazin ... 566,285
Lamp for electric railways, automatic signal, D. O. Beckwith ... 566,283
Lamp, gas burning, N. H. Brown ... 566,055
Lamp holder, extension electric, E. C. Kuenneth et al ... 566,193
Lamp shade holder, P. R. Wagor ... 566,255
Lamps, combined guard and stand for incandescent electric, E. Gahlau ... 566,287
Lamps, drip trough for central draught, J. C. Miller ... 566,208, 566,209
Last standard, F. L. Koffel ... 566,081
Lasting machine, J. M. Holladay ... 565,987
Lathe, G. D. Chapman ... 566,060
Lifting jack, T. N. Ziegler ... 566,117
Lightning arrester, Oelschlager & Schrottke ... 566,011
Limekiln, E. V. Wingard ... 566,106
Liquids, clarifying, W. M. Fowler ... 565,973
Lock. See Door or sash lock. Elevator car lock. Elevator shaft door lock. Sash lock. Twine lock.
Lock, C. W. Squires (reissue) ... 11,564
Loom batten, J. Poyser ... 566,222
Lubricator. See Bicycle lubricator.
Lunch box, collapsible, G. W. Weber ... 566,042
Match splint machine, G. W. Sample ... 566,279
Measure, self registering lumber, H. W. Congdon ... 566,140
Measure, tailor's, E. P. Follett ... 566,158
Measuring device, grain, N. A. Field ... 566,155
Meat suspender, Swartz & Wood ... 565,943
Medicine glass, I. J. Duck ... 566,067
Milk, pasteurizing, Fagersten & Korssell ... 566,268
Mill. See Rolling mill. Windmill.
Mill for grinding liquid substances, P. Faust ... 566,069
Milling machine, E. Johnson ... 565,992
Millstone, H. M. Barr ... 565,873
Mixer. See Wheat mixer.
Moistening postage stamps, etc., device for, E. F. Gafney ... 565,974
Motor controlling apparatus, S. D. Field ... 566,070
Motors, power gearing for electric or other, E. A. Sperry ... 565,936
Music holder, W. D. Henderson ... 565,897
Musical instrument, L. K. Datnan ... 566,146
Musical instrument, mechanical, P. Ehrlich ... 566,150
Necktie holder and collar clasp, A. McDowell ... 566,215
Newspaper holder, L. G. Wade ... 566,254
Non-halation plate, E. Wuestner ... 566,111
Nut and bolt lock, A. N. Woodard ... 566,050
Nut lock, S. W. R. Mitchell ... 565,911
Nut lock, M. L. Suggs ... 565,942
Opera glass, M. Moneyment ... 566,274
Ore sampler, S. I. Hallett ... 566,169
Ores, apparatus for desulfurizing and condensing base metal, S. A. Young ... 566,115
Organs, mechanism for supplying air to bellows of church, C. E. Angell ... 566,051
Ozone and luminosity by electricity, apparatus for producing, E. Andreoli ... 565,952
Pail handle, J. B. Slade ... 566,028
Paint and making same, preservative, P. Janssen ... 566,183
Pan. See Frying pan.
Paper doll, P. B. King ... 565,994
Paper interlining for dresses, machine for manufacturing, J. T. Ryan ... 566,278
Paper, etc., machine for feeding sheets of, J. H. Knowles ... 565,905
Pen, fountain shading, M. Heitmann ... 565,982
Pen, hog, J. L. Gilmore ... 566,163
Pipe joints, inclosing seal for, A. H. Bernstein ... 565,874
Pipe truing and dressing machine, J. M. Bailey ... 566,123
Placket fastener, C. F. Littlejohn ... 566,270
Planing machine, wood, Lawrence & Tillison ... 566,082
Plant thinner and weeder, J. Koegel ... 565,906
Planter and guano distributer, seed, O. R. F. Whitten ... 565,949
Planter check row attachment, corn, W. H. Jarmin ... 565,902
Plaster, corn, A. E. Isaacs ... 565,901
Plow, W. R. Oyler ... 566,218
Pneumatic dispatch tube, C. F. Pike ... 566,016
Pneumatic dispatch tube system, C. F. Pike ... 566,013, 566,015
Pneumatic dispatch tube systems, curved tube for, C. F. Pike ... 566,014
Poison distributer, L. G. Tuttle ... 566,251
Post. See Hitching post.
Pottery moulding machine, D. Taylor ... 566,036
Power. See Pumping power.
Power converter mechanism, J. A. O. Livoni ... 566,198
Power from moving trains, generating, W. J. Morden ... 565,912
Press. See Brick press. Dental flask press. Printing press. Stamping press.
Press, W. T. & I. E. Snowden ... 566,238
Pressure regulator, H. Glanz ... 566,164
Printing cylindrical articles, machine for, C. H. Bunting ... 566,059
Printing machine perforating or scoring attachment, J. L. Nichols ... 566,090
Printing, multicolor, P. G. Frauenfelder ... 565,891
Printing press, G. W. Prouty ... 566,223, 566,224
Printing press offset, R. Mason ... 566,206
Pulley block, G. M. Mullen ... 566,213
Pulley stile pockets, machine for cutting, W. Black ... 565,875
Pulleys, die for crowning sheet metal, O. W. Ketchum ... 565,993
Pump, P. H. Hutchinson, Jr ... 566,179
Pump, air, C. Graefe ... 565,893
Pumping power, G. W. Grimes ... 566,167
Punching machine, multiple, H. C. Jones ... 566,185
Puzzle, W. H. Shellenberger ... 566,236
Quilting frame, adjustable, A. E. Wolford ... 566,049
Radiator feed and return fitting, steam, A. Eichborn ... 566,151
Rail joint, J. M. Halfpenny ... 565,895
Rail, street car, C. Parker ... 566,012
Railway and water tobogganing apparatus, inclined, S. E. Jackman ... 566,182
Railway frog, G. C. Lucas ... 565,998
Railway gate, automatic pneumatic, C. H. Sherwood ... 565,929
Railway switch, F. Greenwald ... 565,894
Railway switch, M. S. Pittman ... 565,921
Railway switch, M. Tremblay ... 566,281
Railways, contact device for conduit electric, M. Stobrawa ... 566,035
Rake or broom, A. Woeber ... 566,048
Ranges, etc., protecting pocket for, S. C. Noble ... 566,009
Ratchet wrench, T. Schaefer ... 566,229
Reflector, A. Gobring ... 566,165
Refrigerator, C. R. Hoeborn ... 565,984
Refrigerator, display, Ehleb & Daugherty ... 565,969
Refrigerator shelf, rotary, F. M. Lochen ... 565,908
Register. See Cash register.
Regulator. See Pressure regulator. Timepiece regulator.
Rolling mill, O. Klatte ... 565,996
Rotary engine, G. P. Fischer ... 566,156
Rule and stamp holder, combined measuring, W. M. Simonson ... 565,932
Ruler, P. W. Leavitt ... 566,195
Sash fastener, E. Jauss ... 566,184
Sash lock, window, H. M. Hastings ... 566,171
Sash, removable window, W. H. Grove ... 566,168
Saw filing apparatus, C. G. Mitchell ... 566,008
Saw filing machine, Wallace & Coyle ... 565,947, 565,948
Saw table, Stevens & Hoffman ... 565,949
Scale or weighing beam, G. H. Froggatt ... 566,160
Scarfing machine, J. C. Killam ... 566,187
Scissors holder, A. D. Polsgrove ... 566,277
Screen. See Coal screen. Window screen.
Seaming machine feed mechanism, attachment for, H. Schaake ... 566,097
Seed or grain, apparatus for gathering, R. W. Shely ... 566,099
Sewing machine, buttonhole, W. R. Abercrombie ... 565,951
Sewing machine feeding mechanism, J. B. Dobyne ... 566,286
Shank stiffener, G. H. Stevens ... 566,240
Sheller. See Corn sheller.
Show case, umbrella, W. V. Parker ... 566,091
Shutter worker, J. W. Kincaid ... 566,188
Sifter, flour, A. F. Darras ... 566,144
Signaling apparatus, A. P. Smith ... 565,933
Skate, combined roller and ice, F. P. Lund ... 566,271
Soldering machine, can end, A. Johnson ... 566,079
Sound conducting device, D. & E. R. Darrah ... 566,145
Spindle ends, apparatus for grinding, F. Ashton ... 566,122
Spinning and twisting frame, Martin & Tolman ... 566,204
Spinning and twisting frame separator, Martin & Tolman ... 566,205
Spinning machine nipper or tension device, J. Neale ... 566,007
Stamp, steam power, J. H. Brown ... 565,876
Stamping press, relief color screw, R. F. Sproule ... 566,239
Starching machine, collar and cuff, S. T. Stites ... 566,242
Steam generator, S. Lacavalerie ... 565,907
Steel and refining of iron ore, production of, Schweitzer & Lungwitz ... 566,026
Stone breaker, R. McCully ... 566,088
Stone cutting, dressing and finishing machine, J. A. Garden ... 565,892
Stopper. See Bottle stopper.
Store service apparatus, W. R. Cole ... 566,139
Stove, cooking, F. Will (reissue) ... 11,563
Switch. See Railway switch.
Switch stand, M. G. Hubbard, Jr ... 565,899
Syringe nozzle, H. P. Scott ... 565,928
Table and bath tub, combined, W. H. Link ... 566,127
Tablet, school cabinet, W. Young ... 566,116
Telephone, C. A. E. Ruebel ... 566,022
Telephone registering device, J. Curran ... 565,965
Telephone system, G. F. Durant et al ... 565,968
Tester, centrifugal, H. B. Weiper ... 566,257
Thread holder, J. W. Mohn ... 566,210
Tiles, machine for making decorative, J. Mobs ... 566,211
Timepiece regulator, W. C. Ball ... 565,955
Tire, bicycle, C. T. Thompson ... 566,247
Tire for vehicle wheels, cushion, A. E. Spencer ... 566,032
Tire, pneumatic, E. W. Young ... 566,112
Tool, combination, H. & H. Hunt, Jr ... 566,176
Tool shank, C. A. Maynard ... 565,910
Torch, oil, Schutte & Vogt ... 566,024
Traction engine, E. Huber ... 565,900
Trap. See Water trap.
Trolley, electric railway car, J. Van Hoogstrate ... 566,252
Trolley pole for electric cars, S. H. Short ... 566,237
Trolley system, underground, J. Hoffman ... 565,985
Trolley wheel, M. C. Furstenau ... 566,161
Trousers stretcher, F. G. Petersen ... 566,221
Truck, barrel, W. A. Hull ... 565,989
Truck, car, W. S. Adams ... 566,118
Truck, car, Mansfield & Baker ... 566,202
Truck for rolling stock, bogie, J. J. Adler ... 566,119
Trucks, power transmitting gearing for electric railway, E. A. Sperry ... 565,938
Trunk and dressing case, combined, E. Witteborg ... 566,262
Trunk fastening, J. Deritis ... 566,148
Tube, M. Svagrovsky ... 566,243
Twine lock, W. W. Martin ... 566,272
Twisting machine, G. L. Brownell ... 565,957
Typewriting machine, W. B. Schwartz ... 566,232
Valve, H. K. Wood ... 566,108
Valve for water tanks, supply, J. M. Closson ... 565,881
Valve operating device, compound engine, E. F. C. Davis ... 566,266
Vanillin, obtaining, J. L. Novarine ... 565,918, 565,919
Vaporizer, oil engine, A. Barker ... 566,125
Vehicle spindle and box, D. M. Loucks ... 566,200
Vessels, system for electroplating, J. H. George ... 565,975
Vise and drill, combined, P. J. Harrah ... 566,170
Vise for holding pipes, C. T. Thompson ... 566,246
Wagon box iron, Coston & Broadhead ... 566,062
Wagon, dumping, D. S. Lane ... 566,194
Waist, W. H. Burns ... 565,959
Watch balances and hair springs, recording mechanism for vibrators for testing, G. E. Hunter ... 566,177
Water alarm for tanks or boilers, G. V. Sheffield ... 566,235
Water, apparatus for using compressed air to elevate, S. W. Titus ... 566,102
Water closet flushing tank, J. P. Locke ... 565,997
Water closets, sinks, sewers, etc., cleaning device for, J. Wrigley ... 566,110
Water trap for gas mains, etc., M. Farrell ... 565,970
Weather strip, H. Voth ... 565,946
Weather strip for doors, automatically closing, W. Gathany ... 566,162
Well drilling and driving machine, G. D. Loomis ... 565,909
Wheat mixer and temperer, Cromwell & Schoonover ... 566,143
Wheel. See Trolley wheel.
Wheel rim, F. Taylor ... 566,244
Whip stock tip, T. W. Bluett ... 566,129
Whistles, apparatus for operating locomotive, J. W. Thomas, Jr ... 566,245
Windmill, J. H. Miller ... 566,002
Window screen, rolling, S. H. Casselberry ... 566,284
Wire stretcher, P. J. & P. W. Sommer ... 566,030
Wire stretcher, W. T. Willie ... 566,261
Wood rim bending machine, L. Rastetter ... 565,923
Wood surfaces, ornamenting, A. Wilcke ... 566,046
Wrench. See Ratchet wrench.
Yarn beam tension regulator, H. J. Trost ... 565,945

DESIGNS.

Belt plate, R. Hickman ... 25,937
Bicycle handle bar, F. C. Rockwell ... 25,953
Bicycle saddle, W. A. & M. H. Hulbert ... 25,952
Bicycle seat, Wilkinson & Dixwell ... 25,951
Bicycle spoke wrench, L. B. Worden ... 25,954
Bottle, G. L. Jenkins ... 25,942, 25,943
Bottle, C. A. Lindgren ... 25,941
Bottle cover, F. Thielke ... 25,940
Box, I. Springer ... 25,962
Can, oil, F. S. Chase ... 25,946
Carpet, F. M. Parker ... 25,967
Cock, basin, J. Totham ... 25,950
Draught lug and draw bar follower, A. G. Steinbrenner ... 25,957
Flour sack, L. C. Sbroeder ... 25,961
Fly paper, J. W. Beattie ... 25,960
Game board, E. J. Thomas, Jr ... 25,965
Glass vessel, T. G. Hawkes ... 25,944
Hame staple, C. B. Rosenburgh ... 25,968
Hammock, I. E. Palmer ... 25,906
Hand drill, T. Larkin ... 25,955
Hook, lacing, E. Kempshall ... 25,939
Lamp, G. R. Steinhauser ... 25,945
Lawn rake, L. Gibbs ... 25,956
Lens frame, test, M. J. Hinden ... 25,949
Pin or badge, Addison & Heald ... 25,935
Puzzle box or case, F. W. Hall ... 25,964
Puzzle box or case, E. M. Peck ... 25,963
Sign and hat rack, C. Hofmann ... 25,948
Silverware border, C. Osborne ... 25,938
Spoon handle, Crees & Court ... 25,936
Stove, heating, E. Gurney ... 25,947
Tobacco, block or body of plug, J. H. Sparger ... 25,959
Trucks, casing for side bearings of car, E. Cliff ... 25,958

TRADE MARKS.

Bakers' products and confectionery and medicated candy, certain named, American Biscuit and Manufacturing Company ... 28,777
Bicycle chains, Indianapolis Chain and Stamping Company ... 28,799
Bicycle saddles, Dickson & Beaning ... 28,800
Bicycles, Fay & McNab ... 28,798
Bleaching powders, carbonate of soda and crystal and sulfate of soda, United Alkali Company ... 28,769
Candles, mixed, Frye Caramel Company ... 28,776
Candy, J. W. Dole ... 28,775
Clock movements, F. Kroeber Clock Company ... 28,793
Crackers and biscuits, American Biscuit and Manufacturing Company ... 28,778
Ear trumpets, J. W. Patterson ... 28,794
Flour, H. A. Hueffner ... 28,780
Flour, wheat, Christensen & Henderson ... 28,779
Food substances, oleaginous, Swift & Company ... 28,781
Grease, oils and other lubricants, Diamond Compound Company ... 28,768
Hats for men and boys, H. H. Roelofs & Company ... 28,760
Malt extracts and peptonized malt foods, A. Lieber ... 28,764
Medicine in pure cane sugar globules, absorbent sugar disks and sugar of milk tablets, Standard Homeopathic Globule Manufactory ... 28,774
Mustard and mustard products, J. & J. Colman ... 28,784
Mustard and spices, Stickney & Poor Spice Company ... 28,791, 28,792
Mustard and table mustard, J. & J. Colman ... 28,785 to 28,790
Oils, illuminating, Warden & Oxnard ... 28,767
Paper and paper board, J. Hofmeier ... 28,762
Perfumes, toilet waters, lotions, soaps and powders, firm of S. Palmer ... 28,771
Pharmaceutical compounds for increasing the pressure of the blood, Chemische Fabrik von Heyden, Gesellschaft mit Beschrankter Haftung ... 28,773
Salts of natural aperient waters and medicinal preparations containing such salts, E. Saxlehner ... 28,765, 28,766
Salves and ointments, A. Lapp ... 28,772
Sewing machines, Central Oilgas Stove Company ... 28,795
Slates, sawed and plain, and rubbed finished slates and slate slabs, roofing, Chapman Slate Company ... 28,802
Soap, A. H. Martin ... 28,770
Sprinklers, Pleuger & Heuger Manufacturing Company ... 28,796
Tea, Haas Brothers ... 28,782, 28,783
Tires, compound for closing punctures in pneumatic, Eagle Chemical Company ... 28,801
Tobacco, leaf, Mexican Tobacco Company ... 28,763
Trimmings, such as braids and bindings, Lesher, Whitman & Company ... 28,761
Wagons, carts, carriages and other road vehicles, Flint Road Cart Company ... 28,797

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

© 1896 SCIENTIFIC AMERICAN, INC.

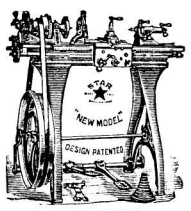
Advertisements.

ORDINARY RATES.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.



Star ★ Lathes

Foot power Screw... ...cutting Automatic Cross feed

9 and 11-inch Swing.

New and Original Features

Send for Catalogue B.

Seneca Falls Mfg. Company,
695 Water St., Seneca Falls, N.Y.

AMERICAN PATENTS.—AN INTEResting and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002**. Price 10 cents. To be had at this office and from all newsdealers

POWER & FOOT LATHES. SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE.
SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

THE CURTIS Steam & Grease SEPARATOR

IT WILL separate water from steam, and so deflect the water that it cannot get back into the current.

IT WILL separate grease and sediment from exhaust steam. The grease may be drawn off at intervals, and the sediment removed. ☞ *Send for Circular S. E.*

D'ESTE & SEELEY CO.
29-33 Haverhill Street, Boston.

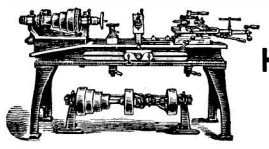
No. 3 POWER PRESS

A strong, blocky, and compact machine for such work as stencil cutting, clock work, gas fixtures, lamp burners, metal fan motors, stove pipe elbows, fruit and fish boxes, paint cans, etc. Will punch 3/8 in. hole in 3/4 in. iron, or will cut blank full size of opening, 3-32 inch thick.

☞ *Send for Circular P. P.* Address

SPRINGFIELD MACHINE TOOL CO.
Southern Ave., Springfield, O., U. S. A.

TURRET BRASS LATHES



and Brassworking Machinery.

Hill, Clarke & Co.
160 Oliver St., BOSTON.
16 So. Canal St., CHICAGO.

The Coburn Patent Trolley Track

Store Ladders.

A PAIR OF STAIRS ALL ALONG THE LINE OF SHELVES.

☞ *Send for Book.*

The Coburn Trolley Track Mfg. Co.
HOLYOKE, MASS.

BARNES'
New Friction Disk Drill.
FOR LIGHT WORK.

Has these Great Advantages:

The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage. Send for catalogue.

W. F. & JNO. BARNES CO.,
1999 Ruby St., - Rockford, Ill.

THINK OF EXTREMES

in the way of mechanical implements, and, whatever they are, you are sure to find them in "**A BOOK OF TOOLS.**"

"A Book of Tools" is the most complete catalogue ever issued. Contains 550 pages and over 2,000 illustrations. Prices are given.

A copy of this book sent postpaid to any address on receipt of 25 cents in stamps.

CHAS. A. STRELINGER & CO.
Address Box 12½, Adv. Dept. DETROIT, MICH.

Physical and School Apparatus

THE THERMOPHONE

A new instrument for

Measuring Temperatures

Will take temperature of anything at any range or distance.

☞ *Circular free.*

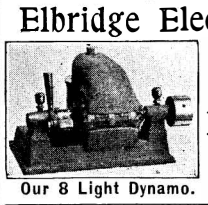
E. S. RITCHIE & SONS,
BROOKLINE, MASS.

ACETYLENE APPARATUS.—ACETYlene number of the SCIENTIFIC AMERICAN SUPPLEMENT, describing, with full illustrations, the most recent, simple, or home made and commercial apparatus for generating acetylene on the large and small scale. The gas as made for and used by the microscopist and student; its use in the magic lantern. The new French table lamp making its own acetylene. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1057**. Price 10 cents. To be had at office.

PERFORATED METAL
OF EVERY DESCRIPTION
AND FOR ALL USES
THE HARRINGTON & KING PERFORATING CO.
225 NORTH UNION STR. CHICAGO ILL. U.S.A.
AND 284 PEARL ST. NEW YORK

ESTIMATES furnished for COMPLETE CRUSHING PLANTS
We manufacture MINING MACHINERY of every description.
Gates Iron Works, Dept. C. 650 Elston Av. Chicago, Ill.

Elbridge Electrical Mfg. Co.



Our 8 Light Dynamo.

ELBRIDGE, N. Y.
MANUFACTURERS OF
. . . High Grade
Dynamos and Motors
for Light and Power.

Repair Bicycles for a Living.—Your boy's hobby may be mechanics; if so, get him the proper tools.

Here is a bicycle repair outfit complete. Illus. catalogue of tools for stamp. Fred. Frasse Co., 21 Warren St., N.Y.

SENSITIVE DRILL

A tool adapted for light drilling. Constructed specially for the use of Bicycle Manufacturers.

C. N. CADY,
West Center Street, Canastota, N. Y.

A Boiler Feeder For High Pressures

WORKS AT 150 TO 250 LBS. STEAM as easily as OUR STOCK INJECTOR AT 25 TO 150 LBS.

May we tell you about it?

PENBERTHY INJECTOR CO.,
116 Seventh Street, DETROIT, MICH.

WATER MOTORS

GAS ENGINES & VENTILATING FANS

The best Motor in the world for driving all kinds of light machinery, noiseless, neat, compact; invaluable for blowing church organs, running printing presses, coffee mills, ventilating fans, ice cream freezers, meat choppers, etc. In use the world over, and recommended by water companies everywhere. Address for circular,
Backus Water Motor Co., Newark, N. J., U.S.A.

If you want the best Lathe and Drill

CHUCKS

BUY WESTCOTT'S. *Strongest Grip, Greatest Capacity and Durability, Cheap and Accurate.*

Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

Green River Patent Spiral Fluted Reamers.

Roughing and Finishing Taper Reamers.

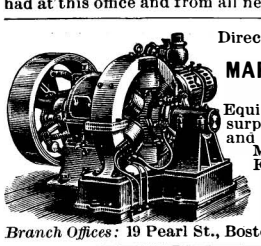
Send for Catalogue.

Wiley & Russell Mfg. Co., Greenfield, Mass., U. S. A.

HARVEY HUBBELL
Machinery and Tool Mfr.
Improved Tapping Machines
SCREWS

Machine Screws for electrical purposes.
Sample box free.
BRIDGEPORT, CONN.

ELECTRO-CHEMISTRY, RECENT ADvances in.—By J. W. Richards, A.C., Ph.D. A very exhaustive and interesting paper on the progress that has recently been made in the apparatus for and methods of prosecuting work in the domain of electro-chemistry. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **1014** and **1015**. Price 10 cents each. To be had at this office and from all newsdealers.



Direct Coupled Engines and Dynamos for
MARINE and LOCAL LIGHT PLANTS

Equipment complete and unsurpassed. Electric Motors and Dynamos, Bipolar and Multipolar. ⅛ to 150 h. p. For particulars, address

BELKNAP MOTOR CO.
HOME OFFICE,
Portland, Me., U. S. A.
Branch Offices: 19 Pearl St., Boston. Thames Bldg., N.Y.

BUY TELEPHONES
That Are Good--Not Cheap Things

The Lynchburg, Va., Telephone Co. tried to get success out of other apparatus and were put to large losses until a change was made to the "Western," 500 capacity of the latter being now operated there at a profit.

Hundreds of similar cases may be cited affecting the apparatus of nearly all so-called competitors.

WESTERN TELEPHONE CONSTRUCTION CO.
250 South Clinton Street, Chicago
The Largest Manufacturers of Telephones in the U. S.

See Illus. Article Sci. Am. June 23, 1894.

The Berkefeld House Filter

The only Filter Removing Typhoid and Cholera Bacilli. Tested and indorsed by many leading authorities in Europe and America. It gives a continuous flow of filtered water, absolutely free from germs. It is easily cleaned, as all impurities remain on the surface of the filtering cylinder. Cylinders can be sterilized by boiling in water for one hour. Send for circulars and prices to the

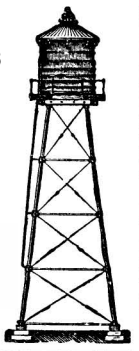
BERKEFELD FILTER CO.,
4 Cedar Street, New York.

Towers, Tanks and Tubs

PATENT SECTIONAL
ALL IRON TOWERS
PLAIN
ALL WOOD TOWERS.
ELEVATED TANKS
for Automatic Fire Sprinkler Plants.

Louisiana Red Cypress Tanks a Specialty.

W. E. CALDWELL CO.,
219 E. Main Street,
LOUISVILLE, KY., U. S. A.



BICYCLISTS, BEWARE

Stop that "chafing" and "wheezing" of your bicycle chain! It means friction, and friction retards progress and lessens speed. You can stop the noise and the wear too by one application of **The B & Z Brush-Top Chain Lubricant,** which creeps into the joints and stays there, preventing both friction and rust and making the machine run easier. Ask your dealer or mailed for a quarter.

BERRANG & CO., Asbury Park, N. J.

DO YOUR OWN PRINTING

$5. PRESS for cards, circulars, &c. Press for printing a small paper, $40.

Save money! Make money printing for others! Type-setting easy. Printed rules. Write for catalogue, presses, type, cards, etc., to factory.

KELSEY & Co.
Meriden, Conn.

"BOOK ON FILES" FREE ILLUSTRATED

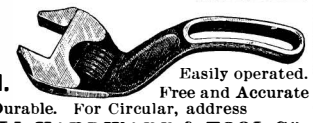
LARGEST NICHOLSON FILE CO.

OUR FILES BITE WELL — WEAR WELL OUR FILES

PRODUCERS

BOX 894
PROVIDENCE, R.I., U.S.A

IMPROVED ADJUSTABLE "S" WRENCH.



Easily operated. Free and Accurate
Strong, Durable. For Circular, address
BEMIS & CALL HARDWARE & TOOL CO.
P. O. Box 1400, Springfield, Mass., U. S. A.

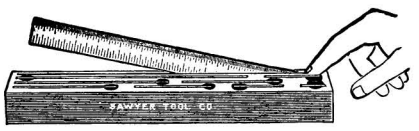
FOR BICYCLE MANUFACTURERS
QUINT'S TURRET DRILLS
Arranged for Tapping with from two to twelve spindles.
A. D. QUINT,
4 Clinton St., Hartford, Conn., U. S. A.

R. POOLE & SON CO.,
ENGINEERS, FOUNDERS AND MACHINISTS,
BALTIMORE, MD.
MANUFACTURERS AND DESIGNERS OF ALL KINDS OF
HEAVY MACHINERY,
REQUIRING FIRST CLASS WORKMANSHIP AND MATERIALS.
BAND, ROPE AND FLY WHEELS, FRICTION CLUTCHES, PULLEYS, SHAFTING AND HANGERS,
MACHINE MOLDED AND PLANED GEARING.
POOLE-LEFFEL TURBINE WATER-WHEELS.
CIRCULARS ON APPLICATION.

WIRE Machinery for making any articles from **WIRE**

Automatic wire forming machine department is in charge of R. C. Manville.
Machinery for making sheet metal goods.
THE WATERBURY MACHINE CO.,
P. O. Box 1025,
WATERBURY, CONN., U. S. A.

SYCAMORE CASE of 1, 2, 3, 4, 6, 9, 12 Inch Tempered Rules



Also 4 inch Narrow and Center Gage. P. P. until Sept. 1st for $4.00. Sawyer Tool Co., Athol, Mass.

TUBULAR DRIVING LAMP.

IT is the only perfect one.
IT will not blow or jar out.
IT gives a clear, white light.
IT is like an engine headlight.
IT throws the light straight ahead from 200 to 300 ft.
IT burns kerosene,
Send for book (free).

R. E. DIETZ CO., 60 Laight Street, New York.
Mention this paper and get special discount.

—ESTABLISHED 1840.—

DEFIANCE MACHINE WORKS

DEFIANCE, OHIO, U.S.A.
BUILDERS OF
HUB, SPOKE, WHEEL, BENDING, WAGON, CARRIAGE AND HOOP MACHINERY.
SEND FOR CATALOGUE

MECHANICAL ...DRAWING

Architectural Drawing; Electricity; Mechanics; Architecture; Plumbing, Mining; Civil Engineering in all Branches; Steam Engineering (Loco., Stat'y, and Marine).

The International Correspondence Schools

TAUGHT BY MAIL THOROUGH PRACTICAL TRADE MARK REGISTERED

To Machinists,

Pattern Makers, Carpenters, Steam Engineers, Draughtsmen, Steam Fitters, Electrical Workers, Civil Engineers, Plumbers, Miners. *References Everywhere. Free Circular. State Subject you wish to Study.*

B 942. Scranton, Pa.

SMALL MOTORS for All Purposes.

The best manufactured. Specially adapted fo all kinds of light work, sewing machine outfits toys, dental drills, jewelers' lathes, models, etc. Send for Catalogue. The LEAVITT MOTOR CO., Manufacturers of Electric Motors and Electrical Specialties, 122 Mitchell St., PROVIDENCE, R. I.

DROP FORGINGS
WYMAN & GORDON
WORCESTER, MASS.
28 BRADLEY STREET.

- - THE - -

SCIENTIFIC AMERICAN

☞ ESTABLISHED 1845.

The Most Popular Scientific Paper in the World

Only $3.00 a Year, Including Postage. Weekly--52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **Three Dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Postmasters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 361 Broadway, New York.

Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology. Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT, for the United States, Canada, and Mexico, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year to one address for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,

MUNN & CO., 361 Broadway, New York.

Building Edition.

THE SCIENTIFIC AMERICAN BUILDING EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates* and other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with Floor Plans, Descriptions, Locations, Estimated Cost, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., 361 Broadway, New York.

Export Edition

of the SCIENTIFIC AMERICAN, with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN is published monthly, and is uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places *throughout the world*. $3.00 a year, postpaid, to any part of the world. Single copies, 25 cents.

☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost. Rates upon application.

MUNN & CO., Publishers.
361 Broadway, New York.

© 1896 SCIENTIFIC AMERICAN, INC.

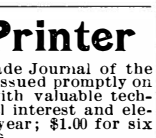
THE BLISS
School of Electricity
Bliss Building, WASHINGTON, D. C.

The only Institution teaching practical Electrical Engineering exclusively. Laboratory equipment excellent. Instruction the best. Catalog on application.

The Inland Printer

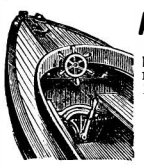
is unquestionably The Leading Trade Journal of the World in the Printing Industry. Issued promptly on the first of every month. Replete with valuable technical information, articles of general interest and elegant illustrations. Only $2.00 per year; $1.00 for six months: 20 cents per copy—none free.
INLAND PRINTER CO., 212-214 Monroe St., Chicago

Patent Improved Self-Lubricating Fifth Wheel
FOR ALL VEHICLES.

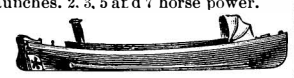


Used and indorsed by leading carriage builders. Lower half is composed of wrought iron. Upper half of fine bronze, in which a series of pockets are set, filled with a compound of graphite under high pressure. Absolutely self-lubricating.
Manufacturers of Graphite Bushings, Bearings, and Washers. *Illustrated circulars sent free.* GRAPHITE LUBRICATING CO., Box S, Bound Brook, N. J.

Durable—Easily Applied.
This roofing is manufactured from natural Trinidad asphalt materials, and will not dry up and become brittle under exposure to the weather as coal-tar roofings do. ☞ *Send for free sample of roof 12 years old, with circular and price list to*
WARREN CHEMICAL & MFG. CO., 85 Fulton Street, New York, U. S. A.



ALCO VAPOR LAUNCH
Engine and Helm Controlled from Bow
Latest improved and only 12 to 1 Motor now ready for the market. 18 to 40 ft. Launches. 2, 3, 5 and 7 horse power.



No licensed Engineer or Pilot required. *Speed and Safety Guaranteed. No Dangerous Naphtha or Gasoline used.*
Marine Vapor Engine Co., Jersey City, N. J.

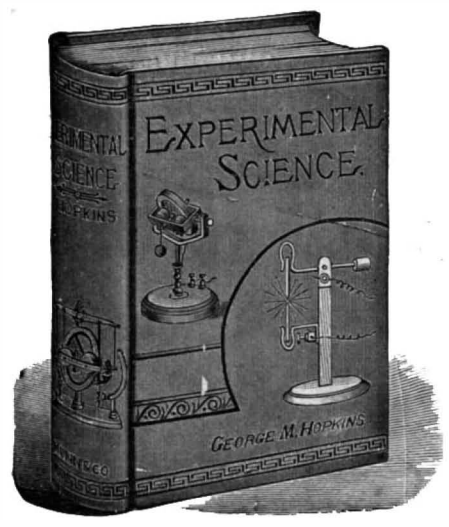
MONITOR
MARINE GAS ENGINES AND LAUNCHES

MONITOR VAPOR ENGINE & POWER COMPANY
GRAND RAPIDS, MICHIGAN.
(EASTERN OFFICE, LUDLOW STATION, YONKERS, N.Y. CATALOGUE FREE.)

KLINE'S PATENT IMPROVED
Boss Jar Holder and Top Wrench
Entirely new—Fits any jar.

No more burned hands in canning fruit—No more broken jars while filling—No trouble to carry hot jars—No more bad temper trying to open jars—No more trouble to close them—Made of best steel wire and rubber—Will last a lifetime. Price 50c. per set
Agents Wanted. KLINE & CO., Mfrs., 4 River Street, Florin, Pa.

Experimental Science
BY
GEO. M. HOPKINS.
Seventeenth Edition.
REVISED AND ENLARGED.



840 pages, 782 fine cuts, substantially and beautifully bound. Price in cloth, by mail, **$4.** Half morocco, **$5.**

This splendid work is up to the times. It gives young and old something worthy of thought. It has influenced thousands of men in the choice of a career. It will give anyone, young or old, information that will enable him to comprehend the great improvements of the day. It furnishes suggestions for hours of instructive recreation.

Send for illustrated circular and complete table of contents. . . .

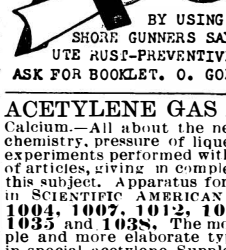
MUNN & CO., Publishers,
Office of the . . .
SCIENTIFIC AMERICAN,
361 BROADWAY, - NEW YORK.

Chain **BELTING of Various Styles, ELEVATORS, CONVEYORS,**
COAL MINING and HANDLING MACHINERY.
The JEFFREY MANUFACTURING CO., COLUMBUS, O.
☞ *Send for late Catalogue "O."* Branches: CHICAGO—NEW YORK.

THE BEST PLACE TO STUDY **ENGINEERING**
Civil, Mechanical, Electrical and Mining, is the
Western University of Pennsylvania
☞ Write for Catalogue to
W. J. HOLLAND, Ph.D., LL.D., Chancellor, Pittsburgh.

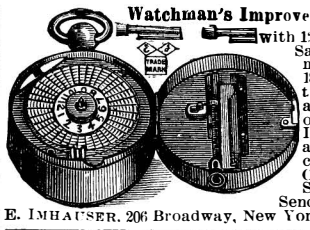
HELLO!
Our New 50c. Telephone
Entirely new and original. The receivers of this Outfit are so constructed that they have extraordinary acoustic properties. A whisper may be plainly heard at 500 ft. No battery required. Receivers are imitation hard rubber, the same in form as used on regular instruments. For inside and all short lines this is better than a $100 Outfit. Complete for both ends with all accessories and instructions for using. Sent by express on receipt of 50c., or by mail for 12c. extra.
R. H. INGERSOLL & BRO. 65 CORTLANDT ST. N. Y. CITY.

CROOKES TUBES AND ROENTGEN'S Photography.—The new photography as performed by the use of Crookes tubes as a source of excitation. All about Crookes tubes. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **181, 189, 238, 243, 244, 792, 795, 905, 980, 1050, 1054, 1055, 1056, 1057,** also SCIENTIFIC AMERICAN, Nos. **7, 8, 10** and **14,** vol. 74. These profusely illustrated SUPPLEMENTS contain a most exhaustive series of articles on Crookes tubes and the experiments performed with them. Among them will be found Prof. Crookes' early lectures, detailing very fully the experiments which so excited the world, and which are now again exciting attention in connection with Roentgen's photography. Price 10 cents each To be had at this office and from all newsdealers.



They have a tone that's all their own . . . . .
THE NEW DEPARTURE BELLS are the standard of excellence the world over. Made in 16 different styles and prices. Send postal for booklet to THE NEW DEPARTURE BELL CO., 210 North Main Street, Bristol, Conn., U. S. A.

Watchman's Improved Time Detector



with 12 or 24 Keys, with Safety Lock attachment. Patented 1875-6-7. My inventions, and will sue all concerns selling or using the Safety Lock attachment. according to Decision of Circuit Court of U. S. for S. D. of N. Y.
Send for circulars to
E. IMHAUSER, 206 Broadway, New York. P. O. Box 2875.

ICE-BOATS—THEIR CONSTRUCTION and Management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **1.** The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

UNION CARBON BATTERY
A perfect battery for electric bells, telephones, etc. Price complete 40c each. $4 per doz. Illustrated circular free. C. M. TURNQUIST, 216 South Clark Street, Chicago, Ill.

UNCLE SAM
is looking
for Bright Young Men
to take the Civil Service Examinations now being held throughout the United States. $1,200 to $2,500 per annum, paid examiners in Patent Office. Full information regarding positions, salaries, dates of examinations, etc. FREE, if you mention the SCIENTIFIC AMERICAN. Write to-day.
Natl. Correspondence Institute, C. S. Dept. Washington, D. C.

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for inventors.
In this line of business they have had *nearly Fifty years' experience,* and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.
A pamphlet sent free of charge on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments. Rejected Cases. Hints on the sale of Patents, etc.
We also send, *free of charge,* a Synopsis of Foreign Patent Laws, showing the cost and method of securing Patents in all the principal countries of the world.
MUNN & CO., SOLICITORS OF PATENTS,
361 BROADWAY, NEW YORK.
BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street. WASHINGTON, D. C.

DO YOU **USE GRINDSTONES?**
If so, we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

MANUFACTURE OF STARCH FROM Maize.—By J. Kriegner. Full details of the process. With one illustration. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1012.** Price 10 cents. To be had at this office and from all newsdealers.

EDGE TOOLS
are often nearly ruined by using a grindstone not adapted to the work. Our quarries produce a large variety of grits suitable for grinding any tool.

☞ *May we send you our Catalogue, which will give you some information?*
GRAFTON STONE COMPANY,
No. 80 River Street, GRAFTON, OHIO.

RUST ON GUNS, TOOLS, CYCLES, ETC.
ABSOLUTELY PREVENTED BY USING - MANNOCITIN
SHORE GUNNERS SAY IT'S THE ONLY ABSOLUTE RUST-PREVENTIVE. 2 OZ. CANS 25 CTS.
ASK FOR BOOKLET. O. GOETZE 116 BROAD ST. N.Y.

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Apparatus for making the gas. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035** and **1038.** The most recent apparatus of simple and more elaborate type described and illustrated in special acetylene Supplement No. **1057.** Price 10 cents each. To be had at this office and from all newsdealers.

MODELS & GEARS EXPERIMENTAL WORK CATALOGUES FREE UNION MODEL WORKS CHICAGO

FULL COLLEGE COURSE IN CHEMISTRY. An article entitled "Chemistry as a General Education," a special Circular of the new Course in Practical Chemistry and a Catalogue of the Polytechnic Institute (chartered as a College in 1890) sent on application to Professor PETER T. AUSTEN, Polytechnic Institute, 99 Livingston Street, BROOKLYN, N. Y.

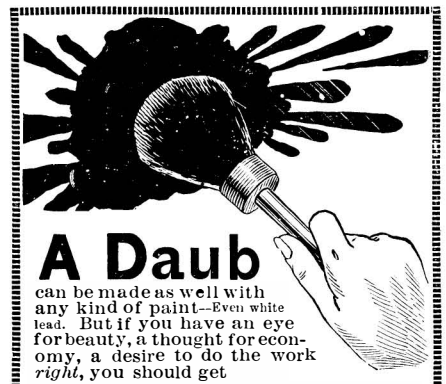
LINENE TRADE MARK **REVERSIBLE COLLARS AND CUFFS.**

MADE OF FINE CLOTH IN ALL POPULAR STYLES.
Equal in Fit and Wear to finest linen
Not to be laundered; when soiled reverse, then discard.
LUXURIOUS and ECONOMICAL.
Sold at all leading Gents' Furnishing Stores, but if not found send **twenty-five cents** for a box of **ten Collars** or **five pairs of Cuffs,** naming the size and style.
☞ *Sample Collar and pair of Cuffs sent for* **6 CENTS.**
REVERSIBLE COLLAR CO. Boston, 77 Franklin St., New York

DEAFNESS
and HEAD NOISES relieved by using
Wilson's Common Sense Ear Drums.
New scientific invention, entirely different in construction from all other devices. Assist the deaf when all other devices fail, and where medical skill has given no relief. Safe, comfortable, and invisible; no wire or string attachment Write for pamphlet.
WILSON EAR DRUM MANUFG. CO., Louisville Trust Co. Building, Louisville, Ky.,
☞ *Mention this paper.* and 1122 Broadway, New York

WANT MONEY?
Easy to make selling BEVERIDGE'S **Automatic Cooker.** Practical and satisfactory. No scorching, no odor. Saves labor and fuel and fits any stove. **Good pay to agents** of either sex. 2385 sold in one town. Write (P. O. 723), BEVERIDGE MFG. CO., Baltimore, Md.

HYPNOTISM Sixty methods, $5; my process $2, 100 page book, 10c. Key to Power, 30c. Prof. Anderson, S. A. 9, Masonic Temple, Chicago.



A Daub
can be made as well with any kind of paint—Even white lead. But if you have an eye for beauty, a thought for economy, a desire to do the work *right,* you should get
PATTON'S PURE LIQUID PAINT
Prepared on scientific principles in Patton Proportions Tested for 40 years and durability guaranteed.
Exclusive agency given to one dealer only in a town. If your town has no agent, order direct. $1.50 per gal., regular house colors. Freight paid to any R. R. station east of Denver. "How to increase the size of your house with paint" free for the asking, 18 combinations of artistic house coloring free of agents, or send us 4 2c. stamps.
JAS. E. PATTON CO., Milwaukee, Wis., U. S. A.
Also Patton's Paint (White Paste Form) Same Quality.

Light and fine machinery to order; models and electrical work specialty. E. O. CHASE, NEWARK, N. J.

FISH You can catch hundreds of FISH if you put PATENT "GILLIS" on your bait. To advertise it, we mail anybody a $1 size package free for 10 cts. MARINE MNF. CO., PALATINE, ILLS. Drawer. 89

DIES Models, Tools, Special and General Machinery made to order. Prices moderate. A. GUENARD 32 to 38 South 6th Street, BROOKLYN, N. Y.

Shorthand by Mail Thoroughly taught by reporters. *Catalogue and first lesson Free.* Potts Shorthand College, Williamsport, Pa.

Wanted—For manufacturing purposes, good patented novelties—cycle improvements preferred. The Gilbert & Chester Co., Elizabeth, N. J.

WANTED—CAPITAL to patent and introduce a valuable invention. Address ANNA LINN, UNION CITY, IND.

THE SCIENCE OF MECHANICS.
DESCRIPTIVE CIRCULAR FREE. OPEN COURT PUB. CO. CHICAGO.

MAGIC LANTERNS WANTED AND FOR SALE OR EXCHANGE.
HARBACH & CO. 809 Filbert St. Phila. Pa.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

BEST DRYING MACHINES FOR GRAIN, SAND, CLAYS, FERTILIZERS, GREEN COFFEE, WET FEEDS ETC. 15 YEARS IN OPERATION. SEND FOR 52 PAGE CATALOGUE. S. E. WORRELL, HANNIBAL, MISSOURI.

IDEAS DEVELOPED. Absolute secrecy. Send for particulars. Advice and suggestions free. Correspondence and sample orders solicited. Models, Patterns, Castings, etc. Gardam & Son, 96 John St., N. Y.

STEEL TYPE TYPEWRITER TYPE
TYPE WHEELS. MODELS & EXPERIMENTAL WORK. SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

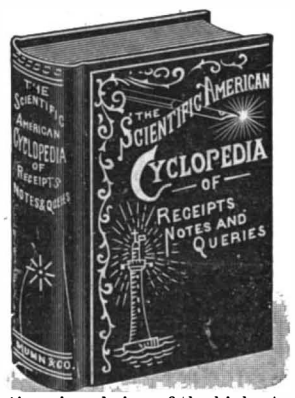
VOLNEY W. MASON & CO.
FRICTION PULLEYS, CLUTCHES, and ELEVATORS
PROVIDENCE, R. I.

CARBORUNDUM
HARDEST ABRASIVE KNOWN. EMERY AND DIAMOND POWDER SUBSTITUTE. IN FLOUR, POWDER-CRYSTAL-WHEEL-SLAB & HONE FORM.
CARBORUNDUM CO. MONONGAHELA CITY, PA. U.S.A.

DIXON'S 691 CYCLE CHAIN GRAPHITE saves wear of chain, prevents rust and increases ease, speed and comfort.
☞ It will pay you to send 10 cents for sample.
JOS. DIXON CRUCIBLE CO., JERSEY CITY, N. J.

INVENTORS
OF SPORTING SPECIALTIES WILL FIND IT OF ADVANTAGE TO CORRESPOND WITH AND SUBMIT THEIR ARTICLES TO H. P. O. BOX 2308 NEW YORK.

Twelfth Edition Now Ready.
THE SCIENTIFIC AMERICAN
CYCLOPEDIA OF Receipts, Notes and Queries
12,500 RECEIPTS. 708 PAGES.
Price, $5.00 in Cloth; $6.00 in Sheep; $6.50 in Half Morocco, Postpaid.



THIS great work has now been on the market for nearly six years, and the demand for it has been so great that twelve editions have been called for.
It is entirely distinct from the ordinary receipt book in being thoroughly up to date.
The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form, convenient for ready use. Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered.
Those who are engaged in almost any branch of industry will find in this book much that is of practical value in their respective callings. Those who are in search of independent business or employment, relating to the home manufacture of salable articles, will find in it hundreds of most excellent suggestions.
☞ *Send for descriptive circular.*
MUNN & CO., Publishers,
361 Broadway, New York.

© 1896 SCIENTIFIC AMERICAN, INC.

Advertisements.

ORDINARY RATES.

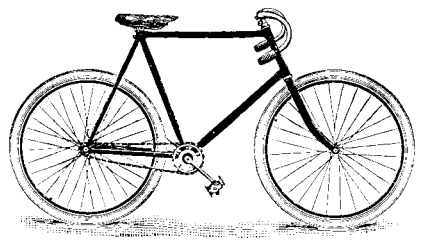
Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Tribune Bicycle

Tested and True.



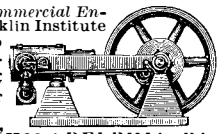
The Easiest Running Wheel in the World.

☞ *Send for Catalogue.*

THE BLACK MFG. CO., ERIE, PA.

PREISTMAN SAFETY OIL ENGINE

"A thoroughly successful commercial Engine using a Safe Oil."—Franklin Institute



No Extra Insurance, No Steam, No Gas. No Gasoline. Reliable, Safe, Economical, and Convenient. Chosen by Nine Governments. Used for nearly every purpose.

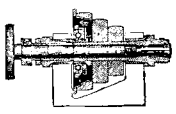
PREISTMAN & CO., Incorp'd, 530 Bourse Bldg., PHILADELPHIA, PA.

Typewriter Patent

This company owns Letters Patent No. 558,428, issued April 14, 1896, covering broadly all machines in which the cylinder turns up to expose the line of print, or in which a duplex or cross ribbon feed is used. The patent also covers many other features of modern typewriter construction. Infringers will be vigorously prosecuted.

Wyckoff, Seamans & Benedict.
327 Broadway, New York.

Stark Anti-Friction Ball Bearing END THRUST
—AND—
STARK ANTI-FRICTION DRAWING SPINDLE

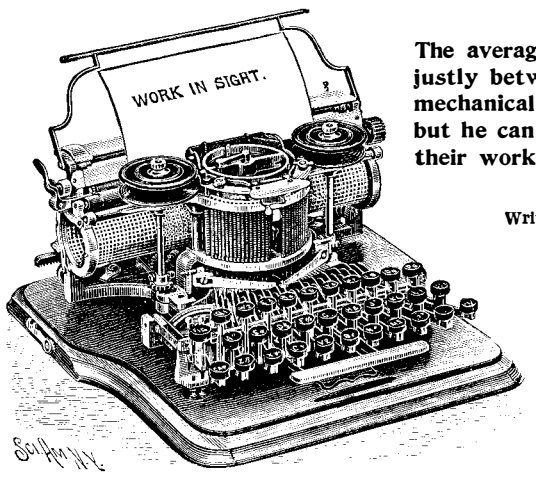


☞ *Send for catalog B.L.*

JOHN STARK, Waltham, Mass.

Tuerk Bros., 35-45 West Randolph Street, Chicago, Ill. Chas. Churchill & Co. Ltd., 21 Cross Street, Finsbury, London, E. C., England.

"The Work's The Thing!"



The average man cannot discriminate justly between machines, so far as mechanical construction is concerned, but he can discriminate between their work . . . . .

Write for catalogue and specimen of work of the

No. 2 HAMMOND

and judge whether a typewriter producing the best work in greatest variety is what you want . . . .

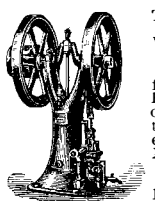
THE HAMMOND TYPEWRITER CO., 401 East 62d Street, New York.

HAVE YOU GOT OUR CATALOGUE L FOR 1896 OF

CAS AND GASOLINE STATIONARY ENGINES
GASOLINE TRACTION ENGINES
COMBINED ENGINES AND PUMPS
GASOLINE PORTABLE ENGINES

USED ANY PLACE BY ANY ONE FOR ANY PURPOSE

CHARTER GAS ENGINE CO., Box 148, Sterling, Ill.



This beats Wind, Steam, or Horse Power. We offer the WEBSTER 2½ actual horse power

GAS ENGINE

for $150, less 10% discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100, therefore we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline.

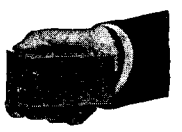
☞ *Write for Special Catalogue.*

WEBSTER MFG. CO.
1074 West 15th Street, CHICAGO

AGENTS WANTED WRITE FOR CATALOGUE AND AGENCY. FOR **FINE TOOLS** IN EVERY SHOP.

C. H. BESLY & CO.
CHICAGO, ILL. U.S.A.

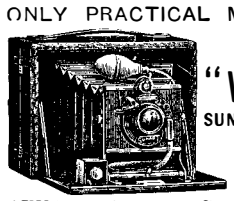
The **$5.00** POCKET KODAK



EASTMAN KODAK CO.,
Sample photo and booklet for two 2-cent stamps. ROCHESTER, N. Y.

At ¼ Price Bicycles, Watches, Guns, Buggies, Harness, Sewing Machines, Organs, Pianos, Safes, Tools, Scales of all varieties and 1000 other articles. Lists free. CHICAGO SCALE CO., Chicago, Ill.

ONLY PRACTICAL MAGAZINE CAMERA.



SUNART'S "VENI, VIDI VICI,"
SUNART MAGAZINE,
SUNART FOLDINGS.

Send for Illustrated Catalogue—2 cent stamp.

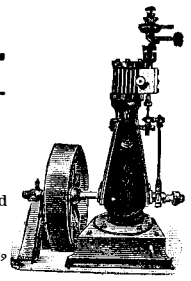
SUNART PHOTO CO., ROCHESTER, N. Y.

GREENFIELD Steam Engine Works.

Established 1874.
Manufacturers of Greenfield Stationary, Portable and Yacht

ENGINES AND BOILERS.

Also Horizontal, Automatic and Variable Cut-off Engines.
Sizes from 3 to 75 Horse-Power.
Also Vertical and Horizontal and Marine Boilers, Steam Pumps and Adams' Grate Bars.



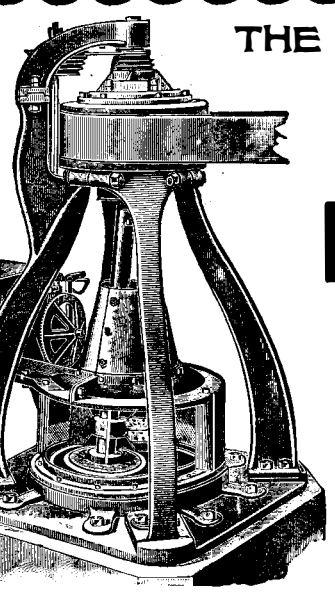
W. G. & G. GREENFIELD, East Newark, N. J.

HALF A CENTURY OF CYCLES.—AN interesting history of the cycle from its origin up to the present time. The first crank-driven bicycle. The "bone-shaker" and its successors. The tricycle. The modern wheel. Cycle building a science. Points of improvement. The pneumatic tire. A hand and foot cycle. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1012. Price 10 cents. To be had at this office and from all newsdealers.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
Wm JESSOP & SONS Lᵗᵈ 91 JOHN ST. NEW YORK

THE ACKNOWLEDGED

PERFECT PULVERIZER



Of All Refractory Substances

Is the **"Griffin Mill,"** whose first cost, wear, and operating expense is much less than stamp mills, and which yields a larger product at less cost than any other mill, with perfect success in every instance.

It will work by either the wet or dry process, and deliver a uniformly sized finished product of from 30 to 350 Mesh, with equal facility. Its capacity is 3 to 4 tons per hour on Phosphate Rock, 1½ to 2 tons per hour on Portland Cement, Quartz Ores, etc.

Correspondence solicited, and illustrated descriptive catalogue sent free by mail on application to

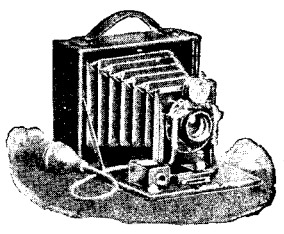
Bradley Pulverizer Co., No. 92 State Street, Boston.

The American Bell Telephone Company,

125 Milk Street,
Boston, Mass.

This Company owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephone, covering all forms of Microphone Transmitters or contact Telephones.

The . . . Premo Camera



Styles for 1896 now ready

ROCHESTER OPTICAL CO., Rochester, N. Y.

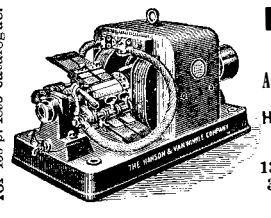
Scientific Book Catalogue

RECENTLY PUBLISHED.

Our New Catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.

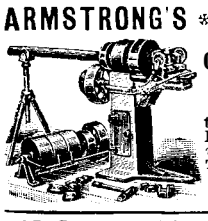
MUNN & CO., *Publishers* SCIENTIFIC AMERICAN,
361 Broadway, New York

Send your business card for 150 p. 1896 catalogue.



NICKEL AND Electro-Plating
Apparatus and Material.
THE Hanson & VanWinkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
35 & 37 S. Canal St., Chicago.

ARMSTRONG'S ✻ PIPE ✻ THREADING
—AND—
CUTTING-OFF MACHINES



Both Hand and Power.
Sizes 1 to 6 inches.
Water, Gas, and Steam Fitters' Tools, Hinged Pipe Vises, Pipe Cutters. *Stocks and Dies universally acknowledged to be* THE BEST. ☞ *Send for catalog.*
THE ARMSTRONG MFG. CO.
Bridgeport, Conn.

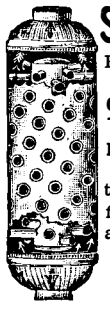
10,000 MILES FOR A DOLLAR!

The Ingersoll Cyclometer, unlike others attaches to the fork-nut axle, leaving the bearings undisturbed. ALSO it requires NO TOOLS and but 1 to 5 minutes time to attach. Very light and small; constantly moving hand; Strictly Guaranteed for 10,000 miles (and repeat); ask your dealer or send us $1.00; mailed post-paid. Bicycle Watch and Holder $1.25. Watch only $1.00. Send for Circular and Sundry and Novelty Cat.

R. H. Ingersoll & Bro., Dept. No. 14, 65 Cortlandt St., New York.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

SAVE ½ YOUR FUEL



By using our (stove pipe) RADIATOR. With its 120 Cross Tubes, ONE stove or furnace does the work of TWO. Drop postal for proofs from prominent men.

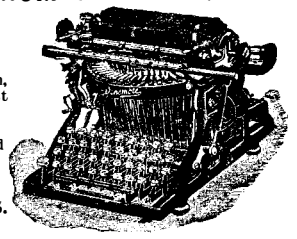
TO INTRODUCE OUR RADIATOR, the first order from each neighborhood filled at WHOLESALE price, and secures an agency. Write at once.

ROCHESTER RADIATOR COMPANY,
82 Furnace St., ROCHESTER, N. Y.

"The . . . . . Light-Running **DENSMORE** . . . . . The World's Greatest Typewriter"

Superiorities Established:

Lightest Key-Touch, Greatest Speed, Most Convenient Paper Feed, Best for both Correspondence and Manifolding, Best System of Scales.



FROM THE U. S. GOVERNMENT.

DEPARTMENT OF THE INTERIOR,
Washington, Nov. 23, 1895.

Densmore Typewriter Company.

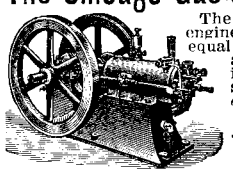
Gentlemen:—We have now in use in the Bureaus of this Department nearly eighty Densmore machines. We have no complaint from the users of them; hence we conclude they are giving entire satisfaction. Respect'y,
(Signed) HIRAM BUCKINGHAM, *Custodian.*

The Dept. of the Interior now uses 127 Densmores.

DENSMORE TYPEWRITER CO., 316 Broadway, N. Y.

WALKER'S SELF-PULLING CORK SCREW
BEST MADE! NO PULLING REQUIRED!
CUTS THE WIRE. TURNS OUT CORK. BUY OF DEALER OR POST PAID 50¢
ERIE SPECIALTY CO. ERIE, PA. U.S.A.

The Chicago Gas & Gasoline Engine



The simplest gas and gasoline engine on the market. Has no equal for absolute, steady speed and durability. It is a dwarf in size and a Samson in strength. *Catalogue sent on application.*

MANUFACTURED BY
J. J. NORMAN CO.,
48 "A" South Clinton St.,
CHICAGO, ILL.

PRINTING INKS

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

© 1896 SCIENTIFIC AMERICAN, INC.